ELECTRICAL TIMES

BICC Cables

for all wiring installations

publications on all types are available on request

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BRITISH INSULATED CALLENDER'S CABLES LIMITED
21, BLOOMSBURY STREET, LONDON, W.C.1

a good archer is not known by his arrow

BUT BY HIS AIM

Yet the choice of a bad arrow can spoil the final result. If your aim is a satisfied customer, take care in your choice of cable. Choose one that you, and your customer, can rely on for years of efficiency. Choose J. & P., the cable produced with the backing of 80 years' experience and leadership in the electrical industry, and hit your target every time.

ALL J. & P. BRANCHES STOCK . . . .

322 TYPES AND SIZES OF V.I.R. CABLE

J. & P. are foundation members of the Cable Makers Association

The mark that means that "little more" in quality

JOHNSON & PHILLIPS LTD.
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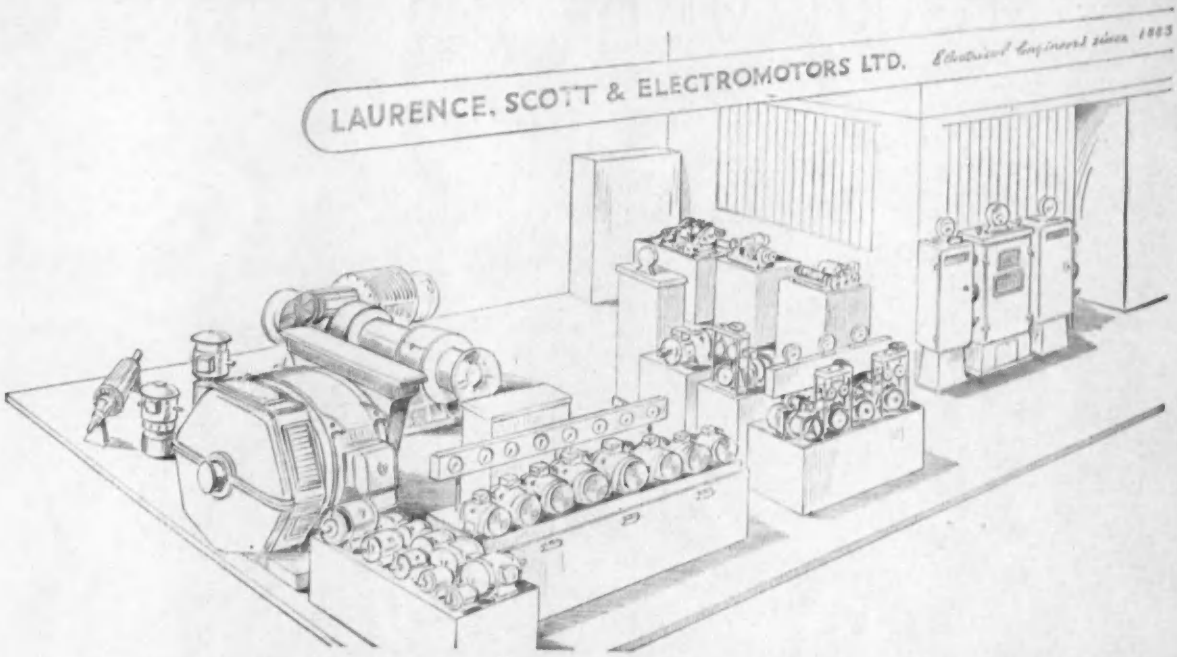
ELECTRICAL ENGINEERS AND CABLE MAKERS



L.S.E. at the ENGINEERING & MARINE EXHIBITION

(Olympia, London, Sept. 1st to 15th)

We hope to demonstrate numerous running exhibits, including :

"REVCON" control system for crane hoist motors and similar applications.

N-S VARIABLE SPEED A. C. MOTORS with various forms of automatic and manual control.

"SPEEDMASTER" single unit frequency convertor for supplying variable frequency.

"ALTOREG" control for self-excited alternators.

"REVCON" cargo winch for direct connection to a.c. supply, without conversion.

"SELECTOR" cargo winch for d.c.

MOORING WINCH, with automatic tensioning characteristics.

Also other examples of L.S.E. motors, control gear and electro-mechanical instruments.

You will find us in our usual position . . . . . **STAND 4, ROW O**
(A particular welcome awaits ex-L.S.E. apprentices) **NATIONAL HALL**

LAURENCE, SCOTT & ELECTROMOTORS LTD.

NORWICH, MANCHESTER & BRANCHES

A

SPEARHEAD OF THE LEGIONS

Roman Development of Copper

Greater use was made by ancient Rome of bronze for articles ranging from coinage to artificial limbs, from domestic utilities to architecture. Julius Caesar shaved before a bronze mirror with a bronze razor, several fearsome types of which are still on exhibition. In some of their work such as water wheel shafting a small quantity of lead was introduced which was an engineering error. They were working on better lines with brass—the alloy of copper and zinc which is thought to have been discovered earlier than 2000 B.C. Today much of the world's production of copper is absorbed by the electrical industry. In 1939 no less than 76% of the British import of copper was of Empire origin.

Quality in material and in construction is of vital importance in all electrical work.

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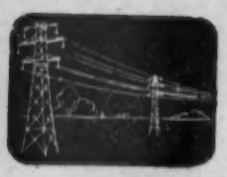
RODS · WIRES · STRIP · STRANDS · SECTIONS AND FORGINGS FOR ELECTRICAL PURPOSES TO STANDARD SPECIFICATIONS OR SPECIAL REQUIREMENTS



FREDERICK SMITH & CO.

Manufacturers of Anacos Bare Copper Conductors.

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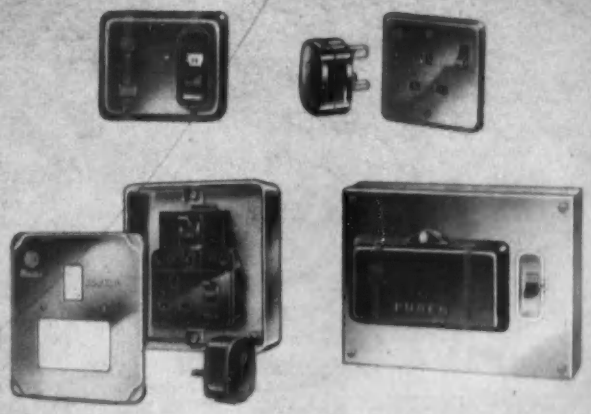
BARE AND INSULATED ELECTRICAL CONDUCTORS OF ALL TYPES

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED	FREDERICK SMITH & CO.	THE LIVERPOOL ELECTRIC CABLE CO. LTD.	VACTITE WIRE CO. LTD.

You cannot buy better gear



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- CROWN SWITCHGEAR 15 TO 60 AMPS
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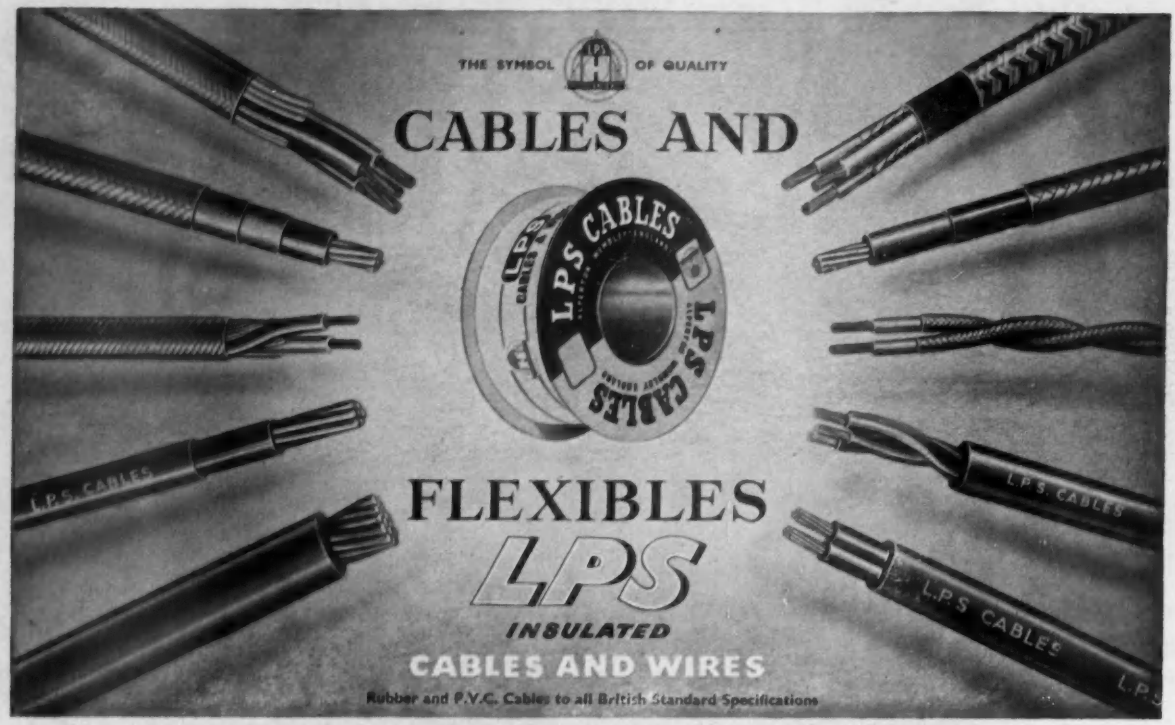
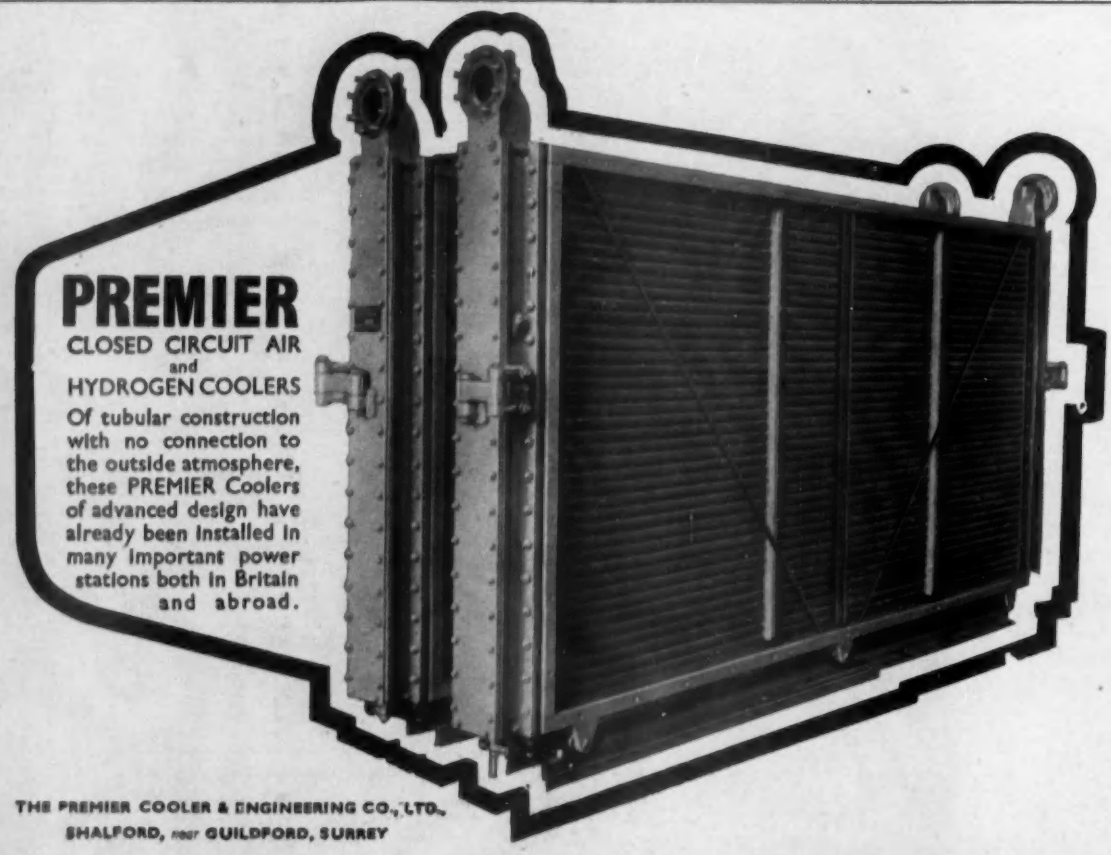


L.P.S. ELECTRICAL CO. LTD.

122 DRURY LANE, LONDON, W.C.2

Telephone: Covent Garden 3232 (7 lines). 'Grams: Engineyor, Phone, London. Also Works at St. Leonards-on-Sea


PREMIER
CLOSED CIRCUIT AIR
and
HYDROGEN COOLERS
Of tubular construction with no connection to the outside atmosphere, these PREMIER Coolers of advanced design have already been installed in many important power stations both in Britain and abroad.

THE PREMIER COOLER & ENGINEERING CO., LTD.,
SHALFORD, near GUILDFORD, SURREY

Model 8 UNIVERSAL AVOMETER

20,000 ohms per volt *plus* AUTOMATIC Overload Protection

Produced in response to a demand for a high sensitivity version of the world-famous Universal AvoMeter, this model incorporates the traditional design features of its predecessors, so highly valued for simplicity of operation and compact portability.

It has a sensitivity of 20,000 ohms per volt on all D.C. voltage ranges and 1,000 ohms per volt on A.C. ranges from 100 V upwards. A decibel scale is provided for audio frequency tests. In addition, a press button has been incorporated which reverses the direction of current through the moving coil, and thus obviates the inconvenience of changing over test leads when the current direction reverses. It also simplifies the testing of potentials, both positive and negative, about a common reference point. A wide range of resistance measurements can be made using internal batteries, separate zero adjustment being provided for each range.

It is of importance to note that this model incorporates the "AVO" automatic cut-out for protection against inadvertent overloads.

Size 8½" x 7½" x 4½"
Weight 6½lbs. (including leads)

£23 : 10s.

For your Valve Characteristic Meter or Valve Tester

Owing to the very large number of valves which have been issued within the last two years, no further amendments will be issued for the original "AVO" Valve Testing Manual. A new, completely revised and fully up-to-date Valve Data Manual is now available from the Company at 15/- post free.

A.C. VOLTAGE	D.C. CURRENT	A.C. VOLTAGE	A.C. CURRENT	RESISTANCE
2·5V.	50μA.	2·5V.	100mA.	*First indication* 0·5Ω
10V.	250μA.	10V.	1A.	*Maximum indication* 20MΩ.
25V.	1mA.	25V.	2·5A.	0—2,000Ω { using internal batteries.
100V.	10mA.	100V.	10A.	0—200,000Ω { using internal batteries.
250V.	100mA.	250V	—	0—20MΩ { using internal batteries.
1,000V.	1A.	1,000V.	—	0—200MΩ { using external batteries.
2,500V.	10A.	2,500V.	—	

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
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SPECIALISTS FOR OVER 30 YEARS

METER BOARDS
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FIRST CLASS WORK · QUICK DELIVERY · COMPETITIVE PRICES

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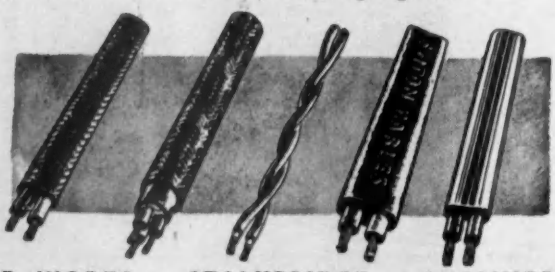
GOOD CONTRACTORS USE ASHTON CABLES

ASHTON has those important qualities which enable first class electrical installations to be made in less time. Ask your wireman to compare ASHTON with other cables and he will tell you it is easier to handle and quicker to install. The insulation can be easily and cleanly stripped with the minimum of effort. And, of course, these cables are made to B.S.S. 7 1953, with laboratory controlled production to ensure that ASHTON remains the supreme name in power and lighting cables.

use and specify Ashton
CABLES and FLEXIBLES



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This is an advertisement of the Aerialite Ltd. Group of Companies

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THESE

are Surrey switches, installed in Rye House Power Station, Hoddesdon, Herts.

Surrey switches were specified by the Eastern Division of the Central Electricity Authority for use throughout the administration blocks of their three newest Power Stations. Sufficient recommendation for quality and reliability of these unique switches.

Complete catalogue of electric wiring accessories available on request.

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THE EDISON SWAN ELECTRIC CO. LTD

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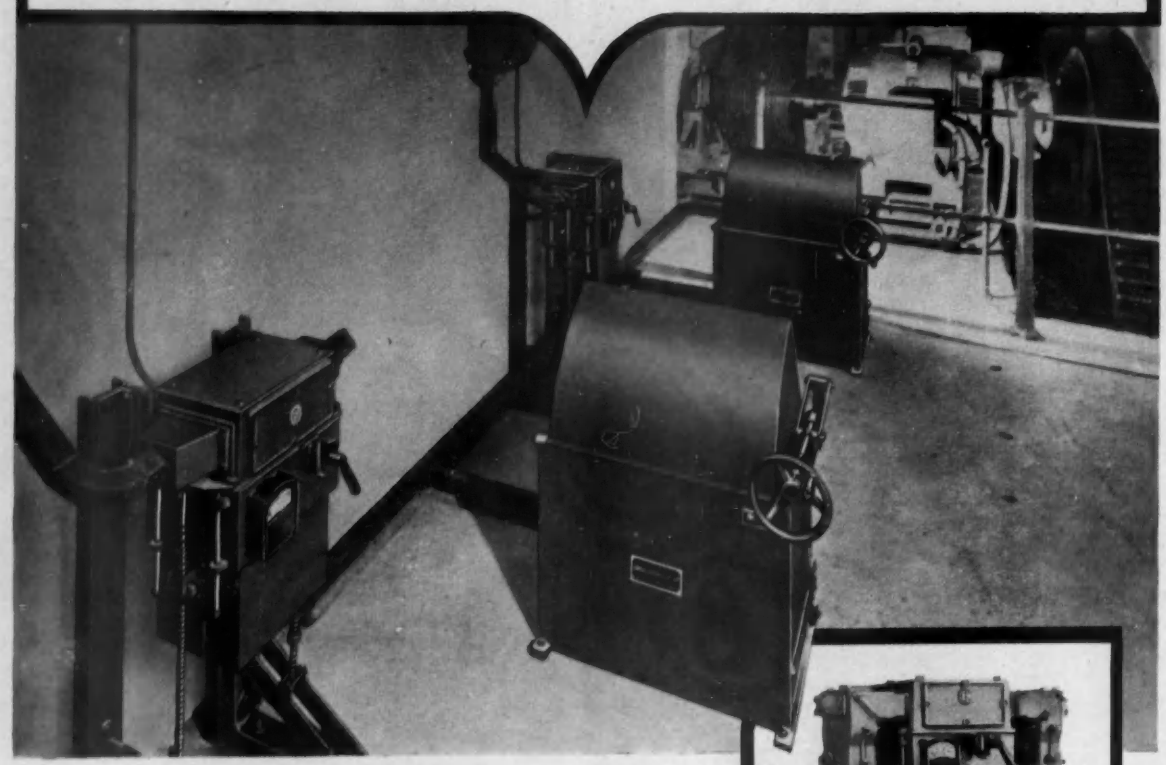
Member of the A.E.I. Group of Companies

E.50

... yet another "Erskine Heap" installation



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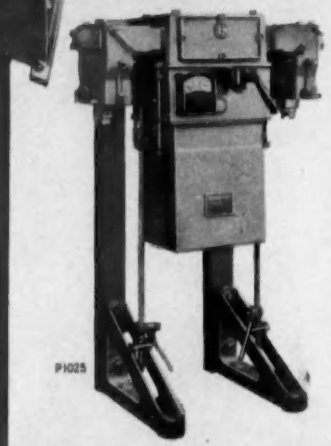
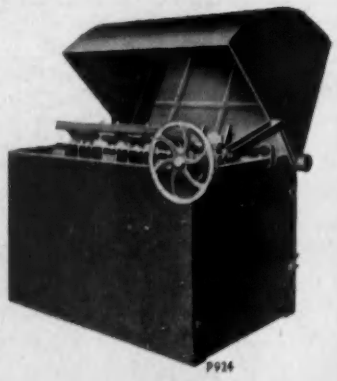
SUPPLIED TO MESSRS. GEO. GOODWIN & SONS LTD., POTTER'S MILLERS, HANLEY.

MAIN CONTRACTORS: BROOK MOTORS LTD. HUDDERSFIELD

The Motor Control Gear in illustration comprises in each case one of our O.S. 22 Type Stator Circuit Breakers and Liquid Type Rotor Starters. In the one case controlling a 130 H.P. motor driving five 12 ft diameter and one 9 ft diameter Grinding Pans. The other controlling a 110 H.P. motor driving four 12 ft diameter and one 8 ft diameter Pans.





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Welcome to our Stand Nos. 34 and 35, Gallery, Grand Hall, Olympia, Engineering, Marine & Welding Exhibition, Sept. 1–15

706

NOW IS THE TIME TO ORDER

MEM ELECTRIC FIRES AND CONVECTORS

New season's range is better than ever

Check over the new season's range of MEM electric Fires and Convectors, and you will find the answer to every customer's needs.

Here are attractive designs and really sound workmanship which will make an immediate appeal to your customers. Every MEM fire complies fully with BS 1670 with its exacting standards of technical performance and quality. All guards conform to BS 1945 to ensure safety in accordance with statutory regulations.

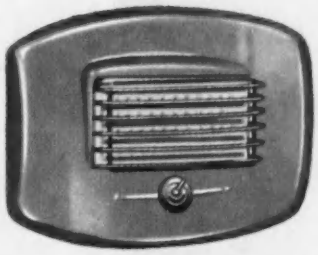
Only MEM methods of production could provide appliances of this quality at such reasonable prices.

Last season's demand was phenomenal. Our planned output was absorbed by the end of November. Make certain you get the fires you want by ordering now.

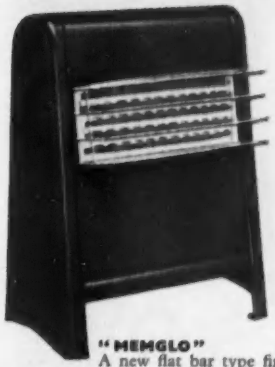
Send for fire list No. 361.

"REFLEX" A best seller in the fixed reflector fire class. Cast iron ends of pleasing design, high quality chrome brass reflector. In 1 and 2 kW ratings. Available in a range of attractive colour finishes.

"MEMRAY" A well made swivel fire, which throws the beam just where it is wanted. Chromed brass reflector, efficient guard, robust construction in 1 and 2 kW ratings.



PANEL FIRES Pleasing modern designs for mounting on walls, with or without recess. Ideal for bedrooms or occasional rooms. Available in flat bar or reflector patterns, 1 and 2 kW ratings.



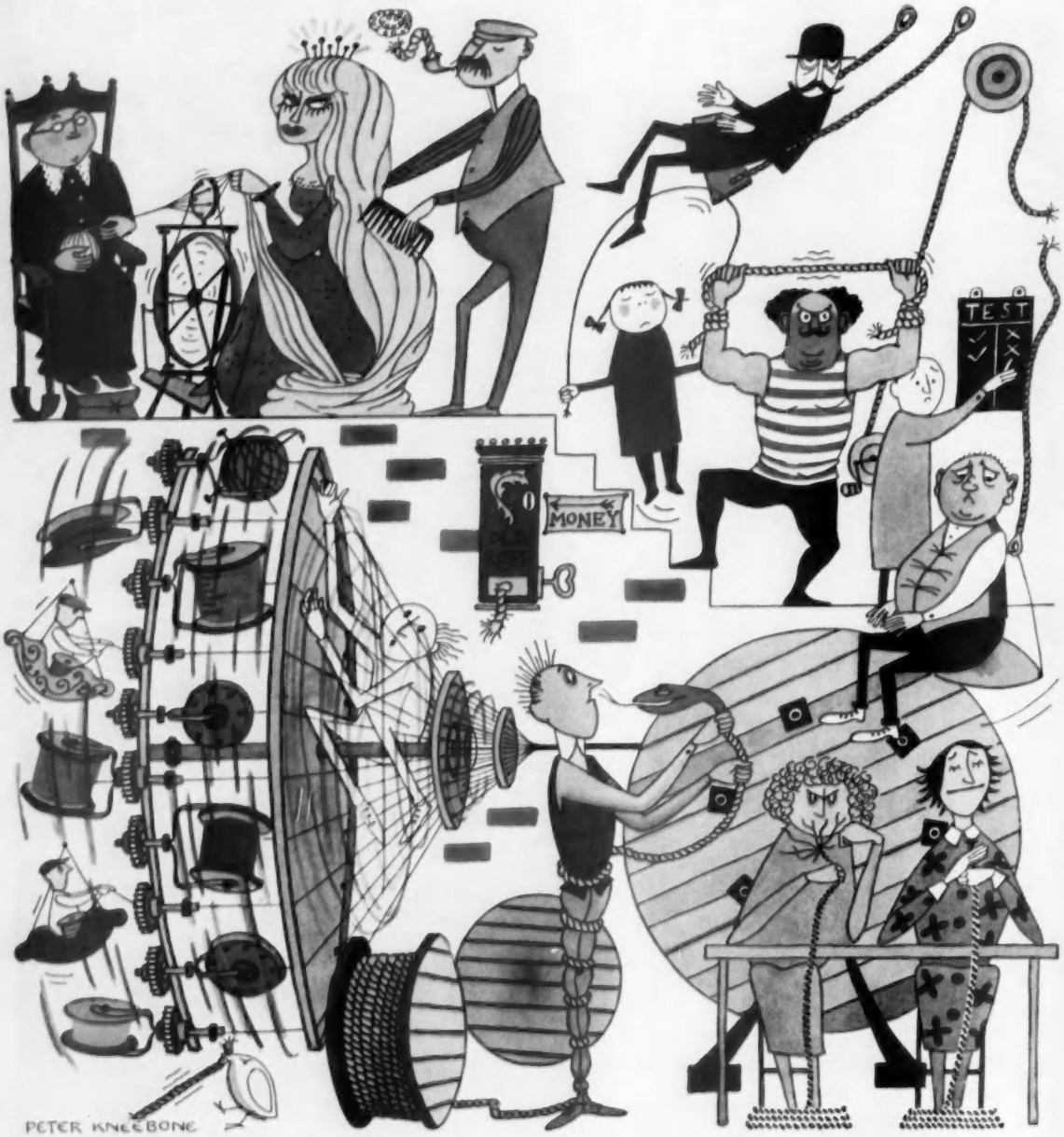
"MEMGLO" A new flat bar type fire of sheet steel construction, light, strong and competitive in price. Attractive simple design. Finish mottled stone only. In 1 and 2 kW ratings.

"CIRCULAIR" CONVECTOR A new portable 1 kW Convector in bronze finish, at an attractive price. Ideal for providing extra heat, wherever a power point is available in the home.

"MEMVAIR" CONVECTORS MEM Convectors established their popularity last season. Handsome, efficient and absolutely safe, they provide top quality heating equipment at reasonable prices. The finish is lovely bronze, long-lasting and easy to clean. Supplied in three ratings—1, 1½ and 2 kW, with or without thermostat.

MEM

MIDLAND ELECTRIC MANUFACTURING CO. LTD.,
Tyseley, Birmingham, 11
Branches at London and Manchester



Oiling the wheels of industry—

ROPE MANUFACTURE

For every modern industrial process there is
a specialised grade of Sea Shell Lubricant.

SHELL

leadership in lubrication

Copies of this advertisement (in colour) can be obtained from Shell-Mex and B.P. Ltd.

NEW ELECO "PERSPEX" FITTING FOR INDUSTRIAL CONDUIT LIGHTING

—Increases Light Output Ratio 10-15%

This new Eleco fitting (patent applied for) is efficient, versatile and economical. It can be used either open, or made completely dustproof with a diffusor cover. The reflectors are made in two grades of opal 'Perspex', whilst the covers are obtainable in three grades, including a pinspot pattern "Perspex". This means that a suitable combination can be arranged to control the percentage of upward light and brightness over a considerable area. Thus, units can be selected to give the best lighting effect for your particular installation.

TOTAL THESE FEATURES— AND YOU GET TODAY'S MOST EFFICIENT LIGHTING

For 100 to 500 watt tungsten Lamps, 80-125 watt MB/V Mercury.

Lighting output Ratio exceeds 85%. Balanced distribution— 10-25% upward light.

High mechanical strength— Resists corrosion.

Low initial cost.

Ease of installation.

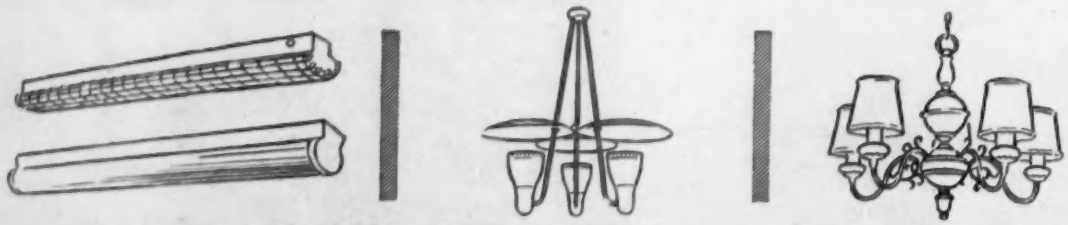
White stove enamelled interior.

For further particulars or help on any lighting problem write to:

ELECO

ENGINEERING & LIGHTING EQUIPMENT CO. LTD.

SPHERE WORKS, ST. ALBANS, HERTS



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FALK, STADELMANN & CO. LTD

Lighting Engineers
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for all
Industrial, Commercial and Decorative purposes

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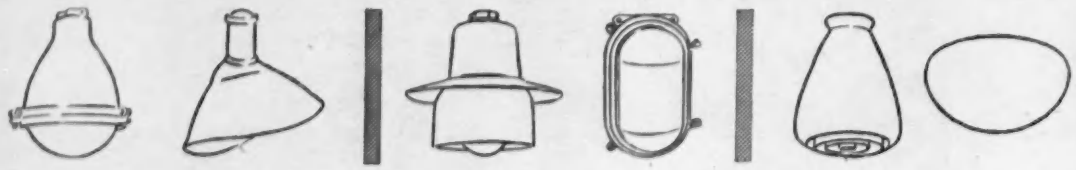

COPPER
commands confidence

From the planning of a job to its completion there is confidence all the way when copper is used. Those who specify it, those who fabricate it, and those who finally use it in service, all know that copper means a permanent job well done.
For economy and efficiency in the application of copper and its alloys use the advisory service of the C.D.A. This entirely free service exists to help copper to help you.

FIRST ASK THE C.D.A.

COPPER DEVELOPMENT ASSOCIATION · KENDALS HALL · RADLETT · HERTS · RADLETT 5616

FERRANTI

7-Range CLIP-ON AMMETERS

TYPE 'V' (Right) 0-10-25-100-250-1000 Amps. and 0-150-600 Volts. Write for List IN.17V

7 ranges -1 switch

TYPE 'A' (Left) 0-10-25-50-100-250-500-1000 Amps. Write for List IN.17A

TYPE 'L' (Right) 0-10-25-50-100-250-500-1000 Amps. Specially designed for use on porcelain-clad fuses and heavy-duty conductors up to 4" dia. Write for List IN.17L

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A leather case with shoulder strap is available for all models at an extra charge

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ELECTRIC CLOCKS · *ALWAYS RIGHT ON TIME*

FI 135/2

USCO

STATIC

PLATE TYPE AIR HEATER

Maximum Economical Heat Transfer and Fuel Saving

Here is good air heater design; flexible to meet varying plant layouts and requirements; giving maximum heat transfer and substantial fuel economy.

CONSTANT HIGH EFFICIENCY
is ensured because there are no moving parts or intricate gas passages and therefore no mechanical maintenance.

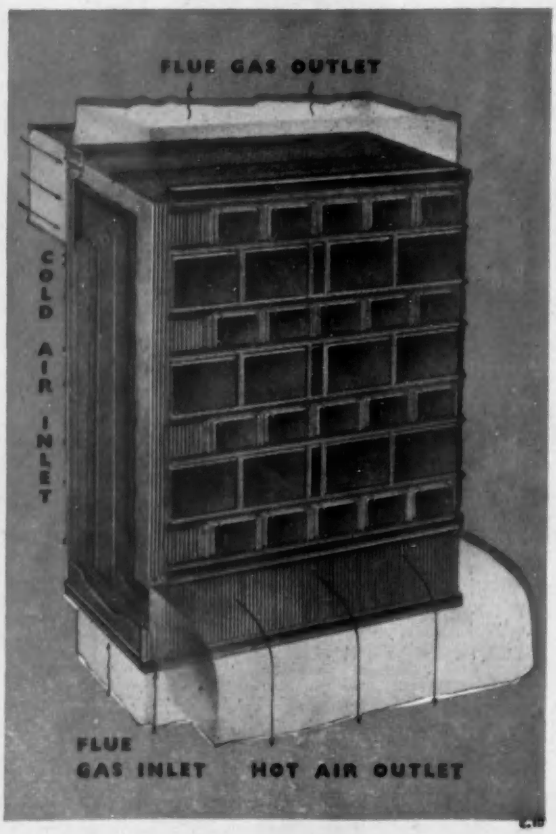
COMPLETE ABSENCE OF AIR LEAKAGE
ensures no overloading of Forced and Induced Draught Fans.

CONSTRUCTION IS GAS-TIGHT
and hence there is no air contamination.

READY ACCESS
is provided for inspection and cleaning.

The heater is applicable to boiler installations, for raising the temperature of combustion air, or to process work, e.g. utilizing waste gases as a heating medium for raising the temperature of air or gas used in process work such as drying, ventilating or certain chemical processes.

Installation of USCO Air Heaters is a sound investment. Saving in fuel costs alone can quickly repay capital outlay apart from gains in plant efficiency.



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Quick testing for every make of relay or meter

"Plug-in" testing, previously possible only with drawout patterns, is now made available for relays or meters of any type or manufacture, with the use of the new 'ENGLISH ELECTRIC' universal test block.

'ENGLISH ELECTRIC'

universal test block

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2.

Meter, Relay and Instrument Division, Stafford.

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

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AMERICANS ARE EXPERTS AT MASS PRODUCTION

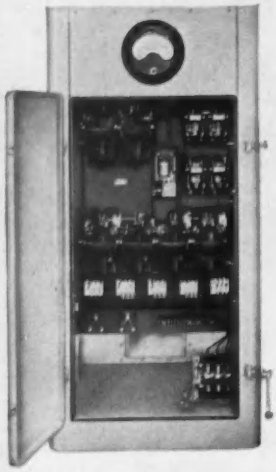
They know that the assembly line must be flexible and have plenty of reserve capacity for increasing output. Most electrical experts realise that this can be achieved by the use of our patented form of cable trunking — which incorporates features that allow for quick changes in the production layout of electrically driven machine tools. Modern innovations include the screwless, easily removable, spring type capping that makes inspection and replacement of circuit wiring a straightforward operation, and a method of fastening which overcomes all vibration. Widely recognised by Industry and Government Departments as by far the most economical and convenient form of trunking, CHANNEL CONDUIT is stocked in sizes 1″ × ½″, 1″ × 1″, 2″ × 1″, 2″ × 2″, 3″ × 2″, 3″ × 3″, 4″ × 3″ and 4″ × 4″. Write or telephone for fully descriptive brochure No. R.A. 51.

THE CHOICE OF THE EXPERTS

CHANNEL CONDUITS LTD.
11 Victoria Street, London, S W.1 *Telephone: ABBey 2027/8*

Custom Built by

BKS



Multi-Motor Control Panels and Sequence Control Panels

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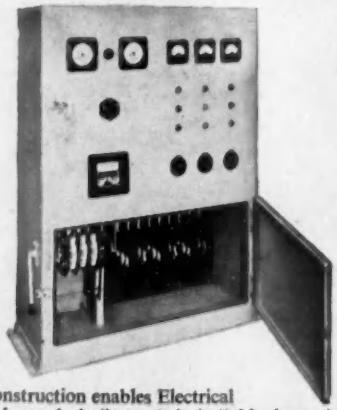
Designed and Built to

Specific Requirements



B.K.S. design and construction enables Electrical Engineers to have control panels built to their individual requirements at moderate costs.

B.K.S. electrical equipment is used extensively by leading authorities and organisations. Our Technical Advisory Service will be pleased to advise on the application of all types of control gear.

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Head Office and Works: **CHERTSEY, SURREY**
Telephone: Chertsey 2067. *Telegrams: Switchgear, Chertsey.*

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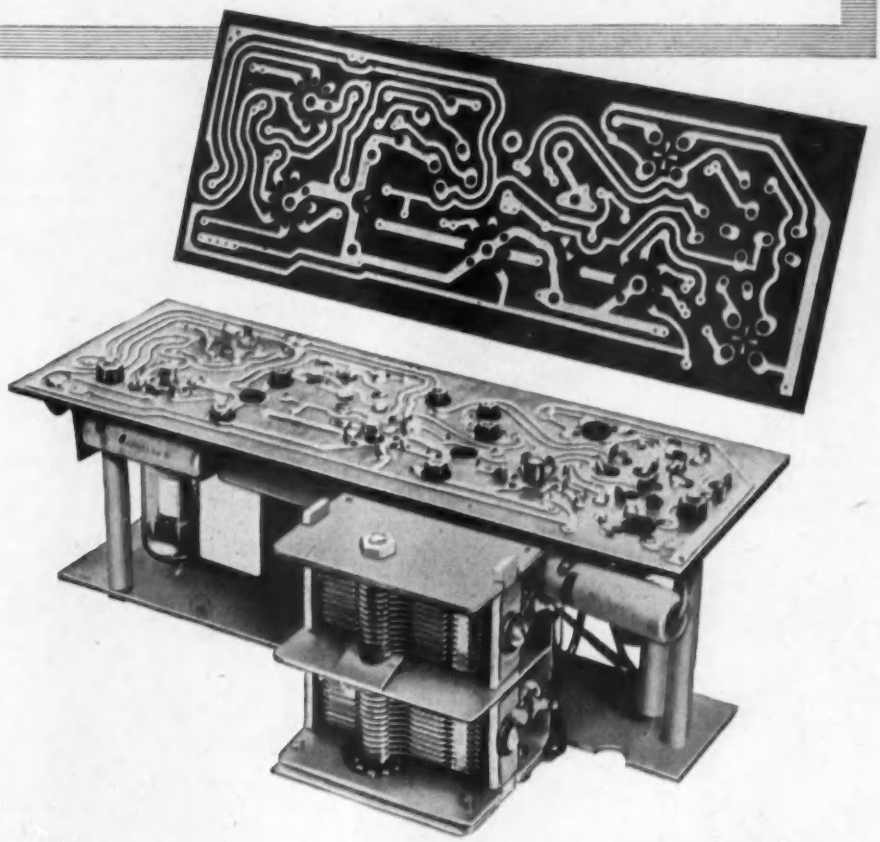
Also at Birmingham.

'Delaron' Copper-Clad completes the circuit...



YOUR TOUR of the exhibition will not be complete until you have seen 'DELARON' Copper-Clad material on Stand 214. This grade of 'DELARON' Laminated Plastic has unique advantages in the construction of radio and television receivers and of radar and electronic equipment. When etched Copper-Clad provides a permanent electric conductor circuit which virtually eliminates hand-wiring and facilitates uniform reproduction. You can see these printed circuits on our stand, the ceiling of which is made of alternate squares of copper-clad already etched.

There are many grades of 'DELARON' Laminated Plastic, made to meet every British Standard and Ministry specification. They have high insulation values, low water absorption, and can be machined easily and quickly. No wonder that 'DELARON' Laminated Plastic has many uses in varied industries.

Delaron
LAMINATED PLASTIC
MADE BY
DE LA RUE

'DELARON' is a registered trade mark

STAND 214

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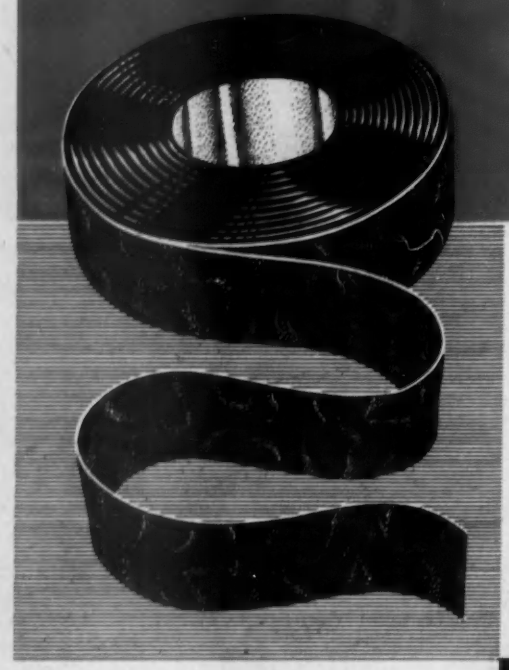
THOMAS DE LA RUE & CO., LIMITED (PLASTICS DIVISION), DEPT. CC1, 84-86 REGENT STREET, LONDON, W.1. Telephone: REGent 2901.



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This Electrical Insulating Material combines High Dielectric and High Tensile Strength with Flexibility.

Available in 25 yd, 36 yd and 50 yd rolls in widths from ⅜" upwards, with Bitumen, Synthetic or Natural Gum Bonds.

We can offer Prompt Delivery at Competitive Prices, and shall be pleased to receive your enquiries for all types of Mica Tapes.

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PC

BUSBAR TRUNKING
— and —
CABLE TRUNKING

The illustration shows a combined installation in a large Irish Textile Factory. Note the convenient method of mounting the Cable Trunking and Fluorescent Fittings.

Busbar Trunking manufactured in the following range :
100–2000 amps.
3 and 4 bar
with
fixed or plug-in
Fuse Boxes

Cable Trunking available
— in —
Surface, Flush, Floor
— and —
Underfloor types
— also in —
Drip-proof and Weather-proof patterns

Please send for descriptive literature.

OTHER PRODUCTS : Cable-Tap System : Rising Main Systems : Fuse Units : Fuseboards : Switchfuses : Switchboards and Accessories.

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Lloyd Street, Wednesbury, Staffs.

'Phone : Wednesbury 0507 (PBX) 'Grams: "Powcent, Wednesbury"
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250 V. A.C. S.P., 5, 15 OR 30 AMP RATING

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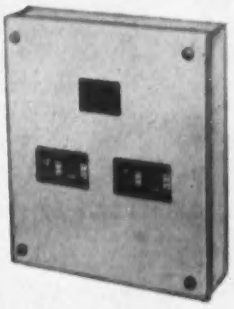
LOADMASTER

THE MOST COMPACT AND LOWEST PRICED CIRCUIT BREAKER UNIT



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MANCHESTER 5. Also at London, Glasgow, Belfast

Glass insulators safeguard Britain's power lines

Photograph by courtesy of the Central Electricity Authority and their main contractors, Messrs. Balfour Beatty & Co. Ltd.

More than 550,000 "ARMOURLIGHT" Toughened Glass Insulators are being supplied for the Central Electricity Authority's 275 kV Supergrid which will carry power to Britain's vital industries, from the Clyde to the Thames.

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They cannot be punctured by lightning surges and they have a high resistance to power arcs. A damaged unit can be detected by quick visual inspection from the ground, thus saving time and trouble and eliminating the need for line testing.

Leading electricity authorities throughout the world are using ever-increasing quantities of "ARMOURLIGHT" toughened glass insulators.

Sections of the 275 kV Supergrid for which "Armourlight" Toughened Glass Insulators are being supplied.

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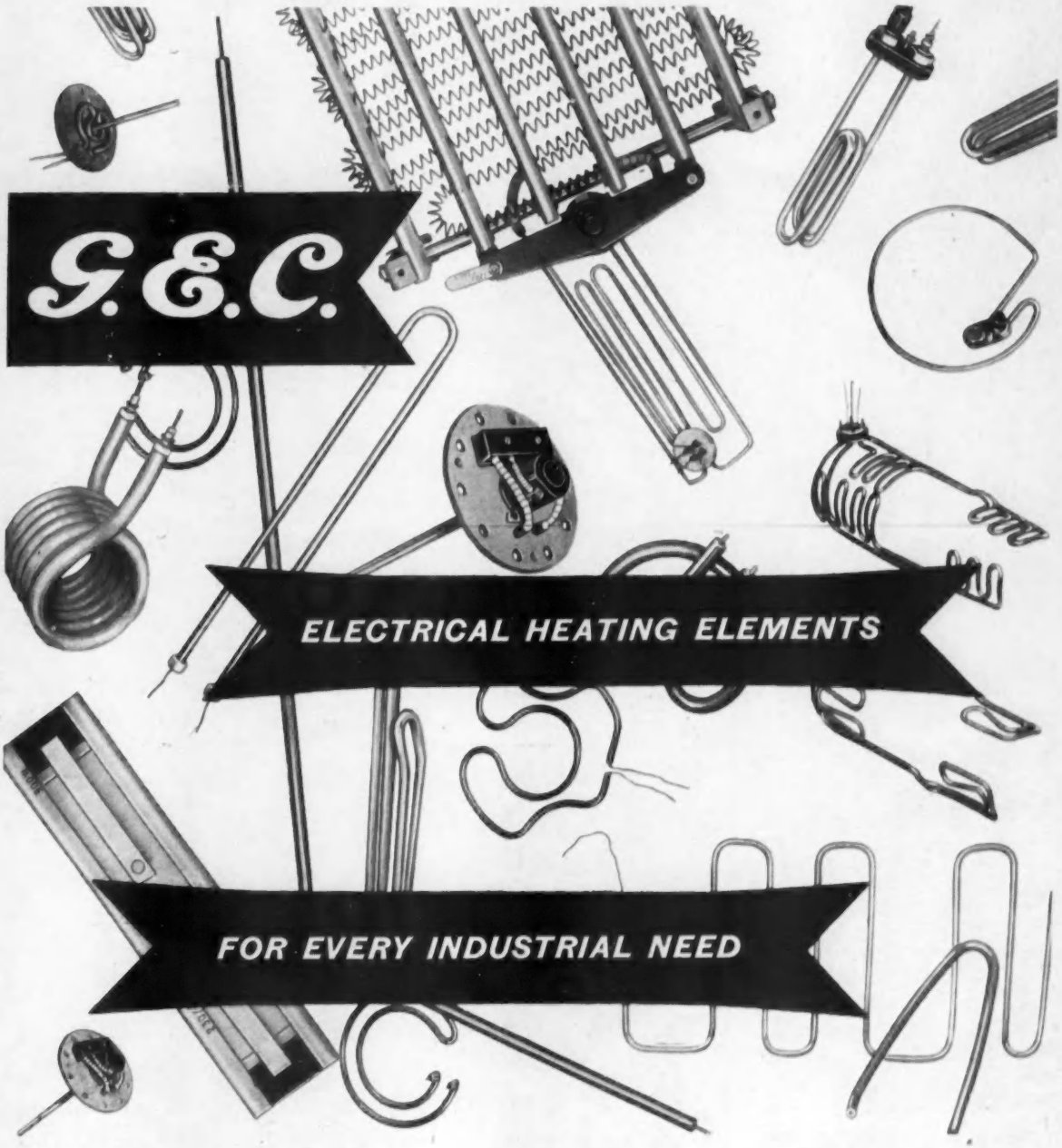
'ARMOURLIGHT' is a registered trade mark of Pilkington Brothers Limited H.V. L7



If your particular product needs electrical heating elements—the G.E.C. can make them for you.

The G.E.C. brings a wealth of valuable experience to the solution of your particular problems. Whatever your product, whatever industry you represent, the G.E.C. can make exactly the right elements for your requirements.

Write to the G.E.C. Industrial Heating Department for further information.

G.E.C. ELECTRIC HEATING ELEMENTS FOR INDUSTRY

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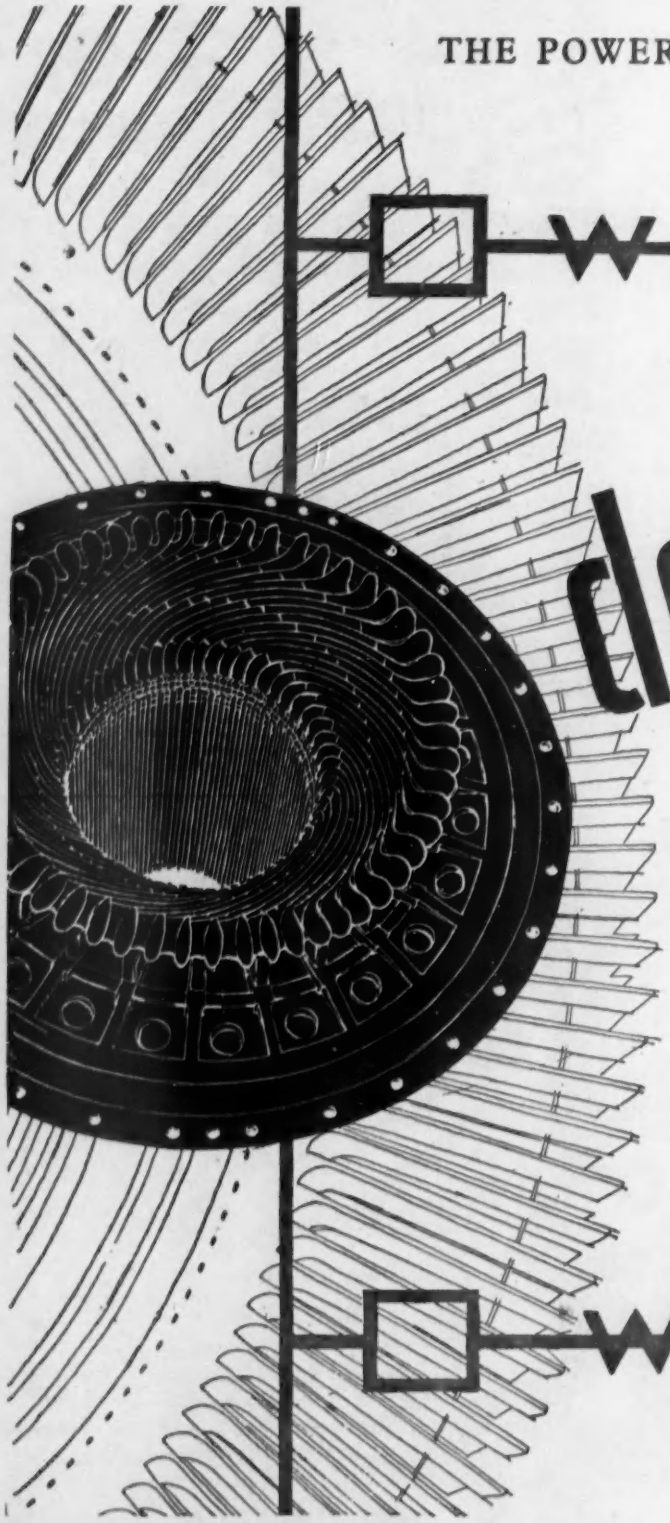

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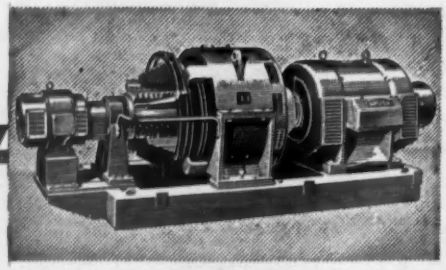
Brush design engineers are constantly devising new and better ways of putting power into harness. Every Brush Power unit is designed *exactly* to do a job perfectly–if needs be 'tailor made' to a particular customer's requirements. Moreover, Brush Products are always designed to meet the maximum stress of their service life–not just to fill the requirements of a specification. In other words, it is creative design plus extra strength and *stamina* that makes Brush Power equipment famous throughout the world.



MOTOR GENERATOR SET *for High Duty Alloys Limited –190 H.P. 400/440 volts, 233 amperes–980 r.p.m. TR.544 Generator–120 kW 60 volts–2000 amperes–980 r.p.m.*

Whatever your power problem...consult

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TRANSFORMERS · SWITCHGEAR · MOTORS · ALTERNATORS · GENERATORS · TURBINES

BRUSH ELECTRICAL ENGINEERING CO. LTD., *Loughborough, England · Member of the Brush Group* BRUSH

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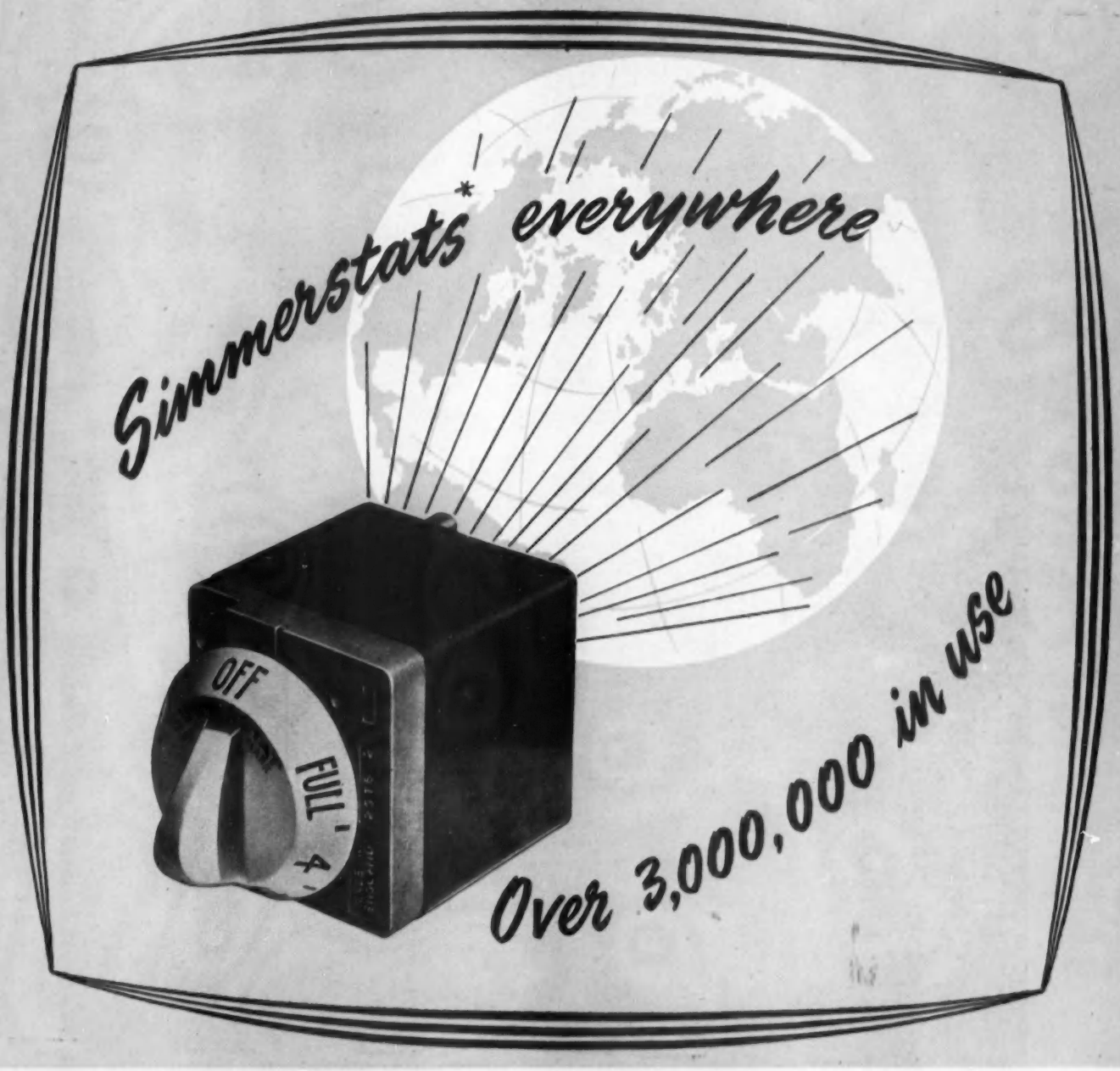

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No. 1 Factory, Eastern Industrial Estate,
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Manufacturers of 'Simmerstat' Regulators, Oven Thermostats, Radiant Hotplates and Pneumatic and Electrical Instruments for detection, measurement, control and recording of temperature, flow, liquid-level, specific gravity and pressure, in science and industry. Vacuum pumping and measuring equipment, etc.

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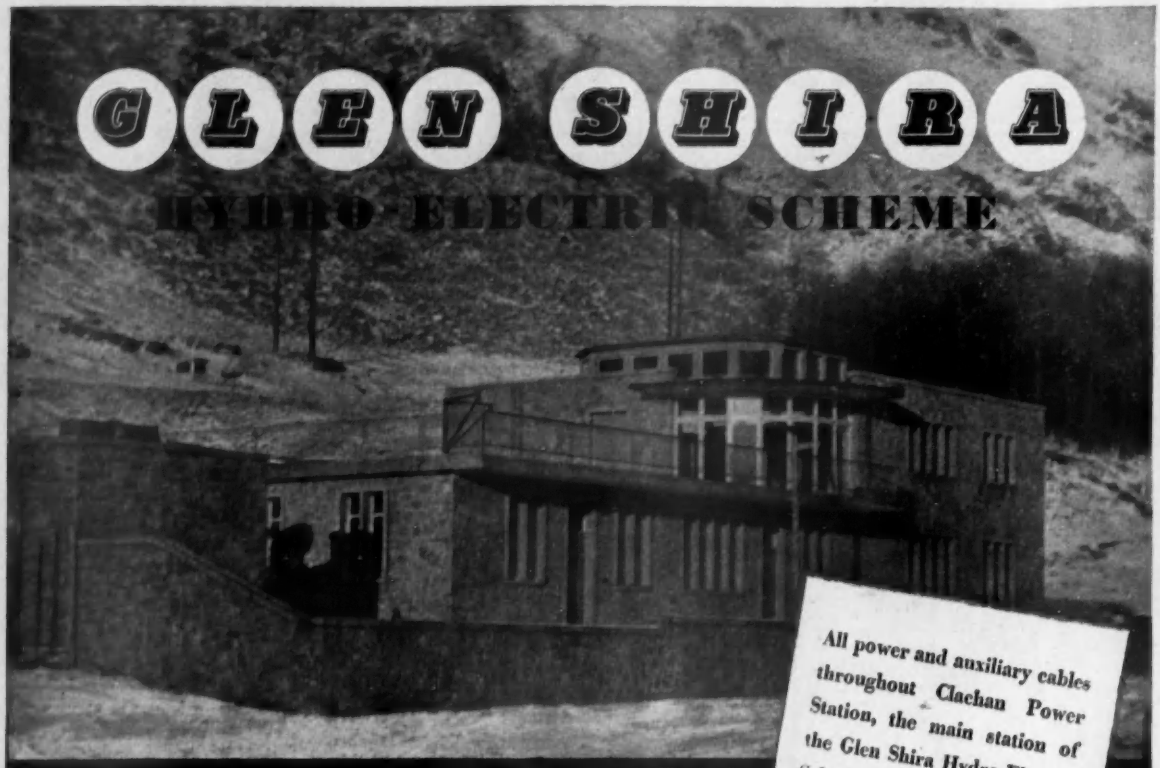
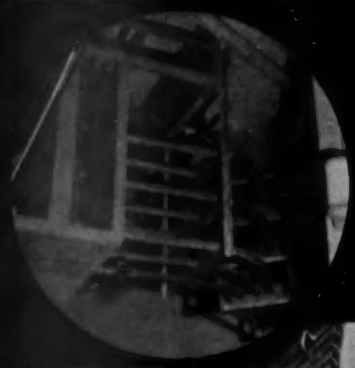


All power and auxiliary cables throughout Clachan Power Station, the main station of the Glen Shira Hydro-Electric Scheme, were manufactured and installed by Scottish Cables Limited on behalf of the North of Scotland Hydro-Electric Board.



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ALTERNATOR

50 MVA TRANSFORMER

CONTROL ROOM

SCOTTISH CABLES LIMITED

DEANSIDE • RENFREW • SCOTLAND

LONDON OFFICE • • BUSH HOUSE • ALDWYCH, W.C.2

Associated Company: SCOTTISH CABLES (SOUTH AFRICA) LTD. PIETERMARITZBURG, NATAL

The new Satchwell VC

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- Satchwell magnetically controlled micro-gap switch
- Interchangeable with thermostats to BS 1555-1949
- Adjustable temperature setting
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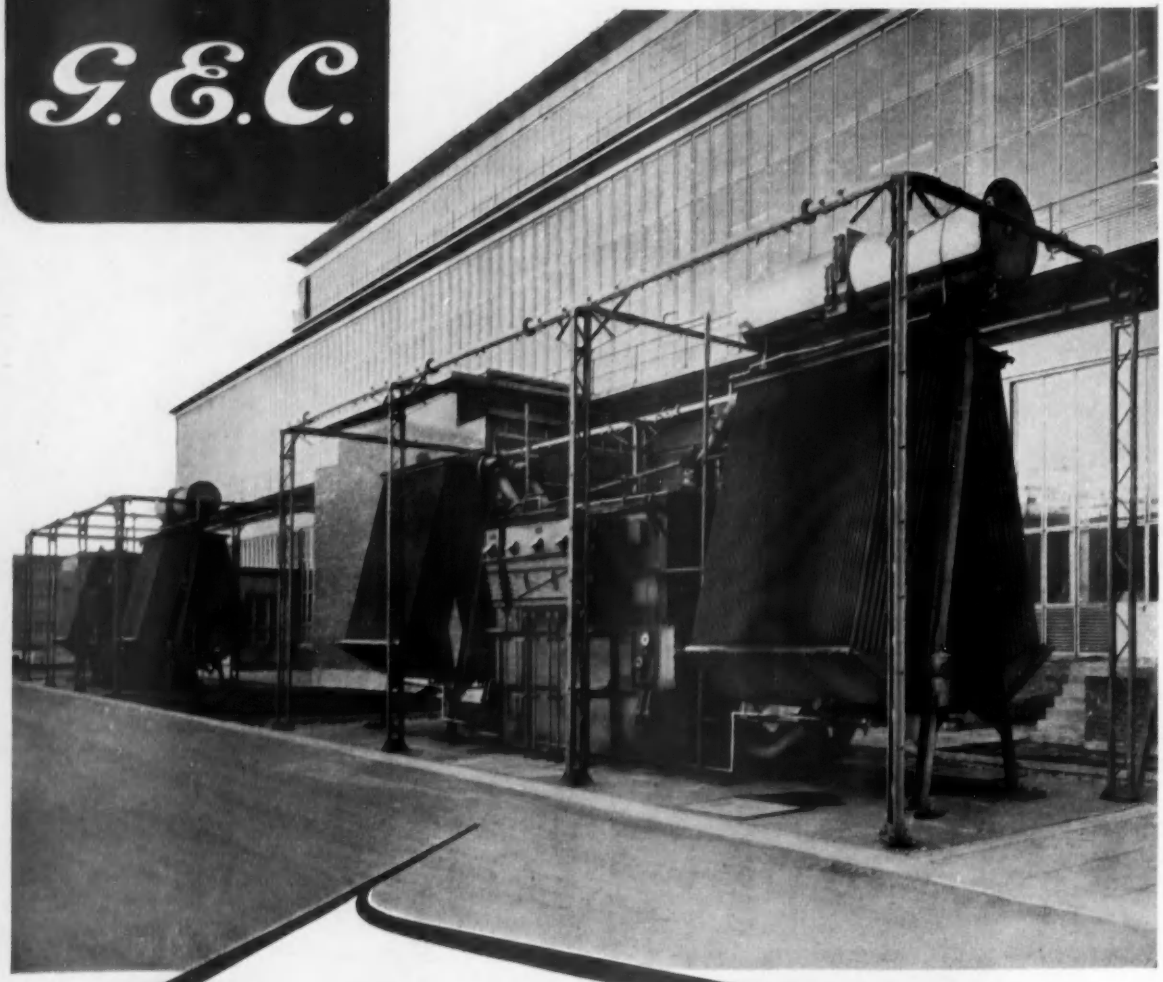


POWER TRANSFORMERS

40.5 MVA, 11 kV/36 kV generator-transformers at the Huncoat power station, Accrington.

THE GENERAL ELECTRIC COMPANY, LIMITED, MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Wire

Let us admit that this bears little resemblance to an advertisement. The artist said he couldn't draw wire! We can. We draw hundreds of miles of it—Copper Wire, plain and tinned and drawn to very exacting specifications, inch by perfect inch.

Without harping on it, we believe that a very large number of our friends in the Electrical Trade know what we do and have complete confidence in our products.

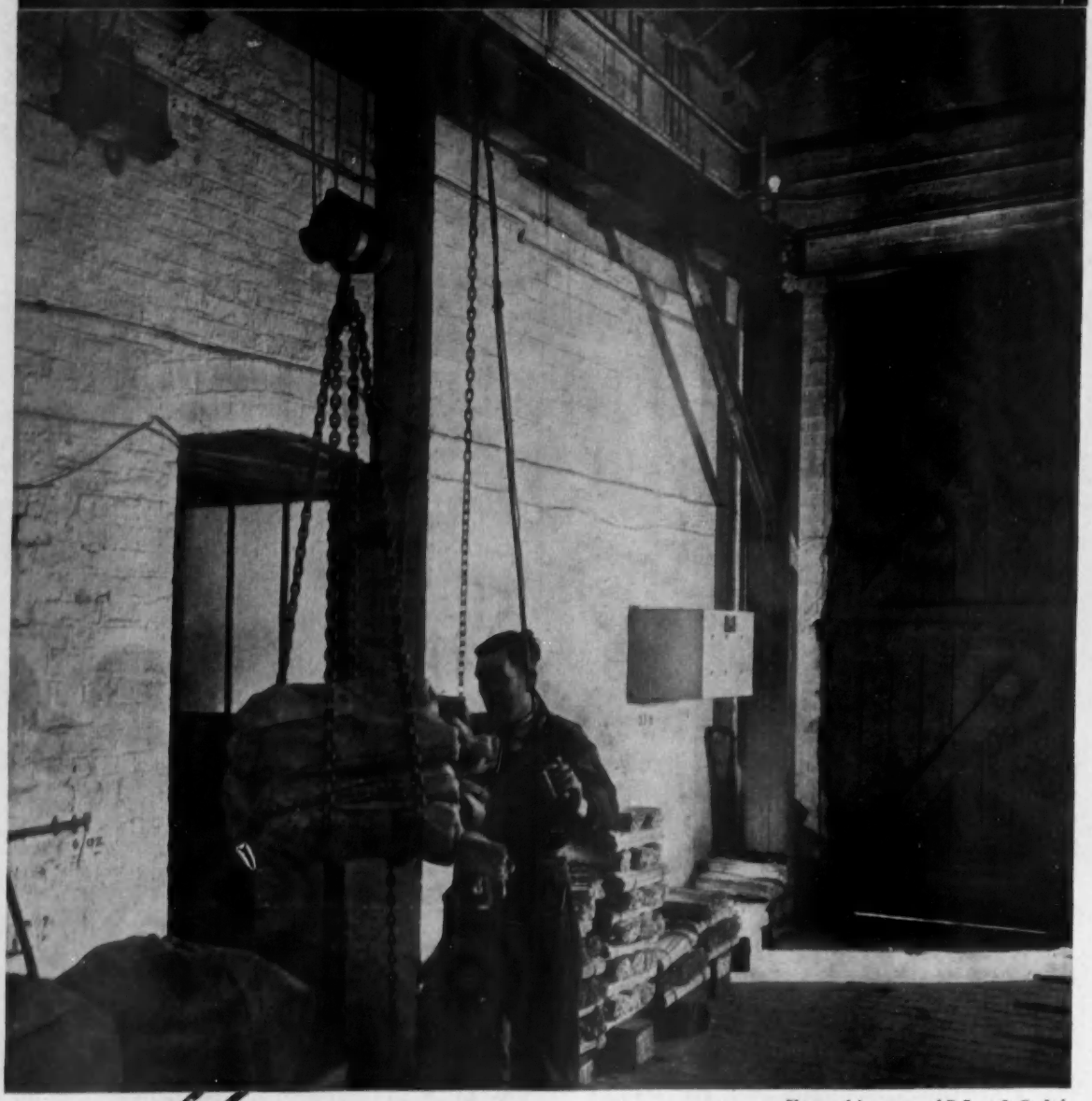
Write to us—but not about harps, please. Telephone: Abbey 2771.

R. H.
SYMONDS
LTD.

47, VICTORIA ST., LONDON, S.W.1.

C

DC POWER FOR HOIST OPERATION



Photograph by courtesy of R. Jones & Co. Ltd.

DOUBLE-VOLTAGE WESTALITE RECTIFIERS

WESTALITE rectifiers, for operation from either single- or three-phase mains, are available for all industrial DC power supplies.

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at the British Plastics Exhibition 1955

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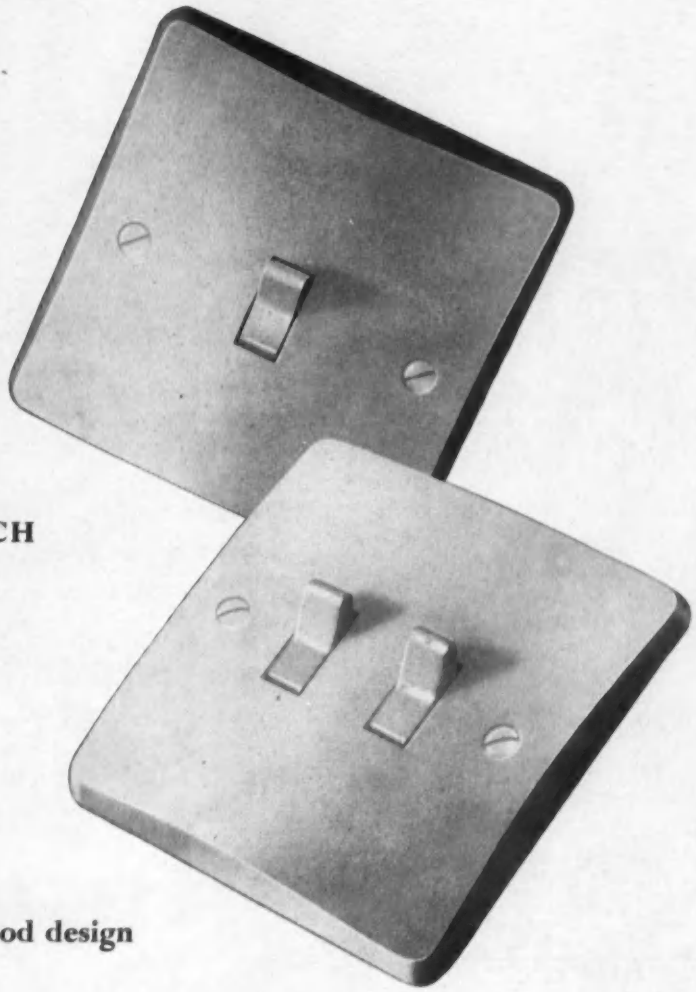


THE MK PLATESWITCH

MK . . . the mark of good design

M. K. Electric Limited, Wakefield Street, London N.18 Edmonton 5151

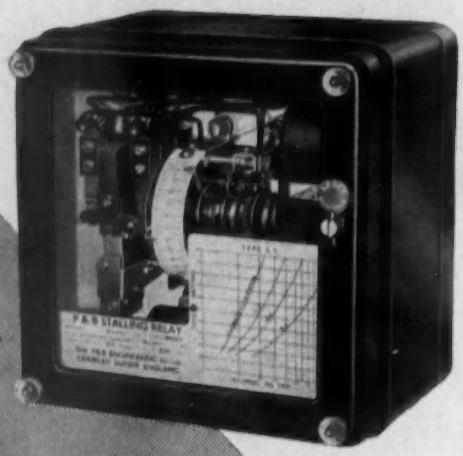
MK113DHB

PROTECT
YOUR MOTORS
against Stalling

A New P & B Stalling Relay

One of the latest products of the makers of P & B Golds Relays, giving complete protection against stalling under all conditions, this Relay incorporates a dead beat thermal timing element and lock-out feature allowing only one attempted restart.

Send for descriptive Pamphlet.

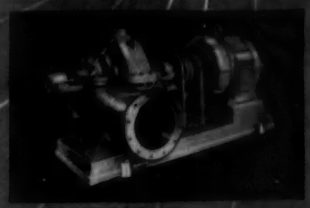


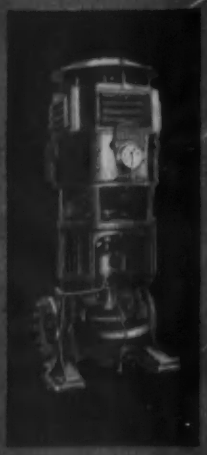
THE P & B ENGINEERING CO · LTD
CRAWLEY SUSSEX
TELEPHONE: CRAWLEY 1804

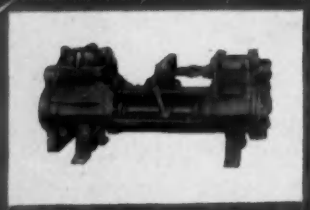
whenever you see a pump

Look for the name
WORTHINGTON-SIMPSON

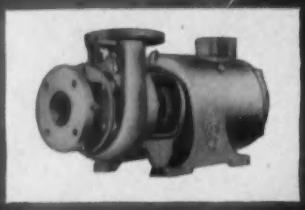
A name known for over a century throughout the world for active participation in the development of modern pumping machinery—every modern facility for testing and manufacturing—world-wide organization for service. These comprise the intangibles, beyond evaluation, represented by the nameplate bearing the name of Worthington-Simpson.


CENTRIFUGAL


NUMARINE


STEAM

POWER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WORTHINGTON-SIMPSON

When it's a question of pumps the engineer goes to
WORTHINGTON-SIMPSON LTD NEWARK NOTTS

ENTRANCE TO AN IMPORTANT RESEARCH LABORATORY

The old Woodhead Tunnel ran beneath the Pennines on the busy Manchester-Sheffield line.

Heavily laden freight trains filled it with a permanent concentration of damp, soot and sulphur-laden fumes. So severe were conditions inside that only fifty yards from the entrance, daylight was usually completely obscured. Moisture running down the walls contained a high percentage of sulphuric acid; and rails had to be renewed every 3½ years.

Ideal conditions for Corrosion Research work we thought!

As designers and erectors of many types of metal structures for railways, the BICC Group maintain fully equipped laboratories to study the problems, and prevention of corrosion. Consequently, with the co-operation of British Railways the tunnel was used to conduct a series of experiments.

Two hundred specimen plates, 6-in. by 4-in., were exposed on a test rack about 200 yards inside the tunnel. Specimens of mild steel, lead, aluminium and bronzes of varying compositions, with and without protective coatings, were tested.

Over the next 18 months selected specimens were removed to the laboratories and examined.

To-day, important information obtained from these experiments is being put to good use for the future protection of railway structures.

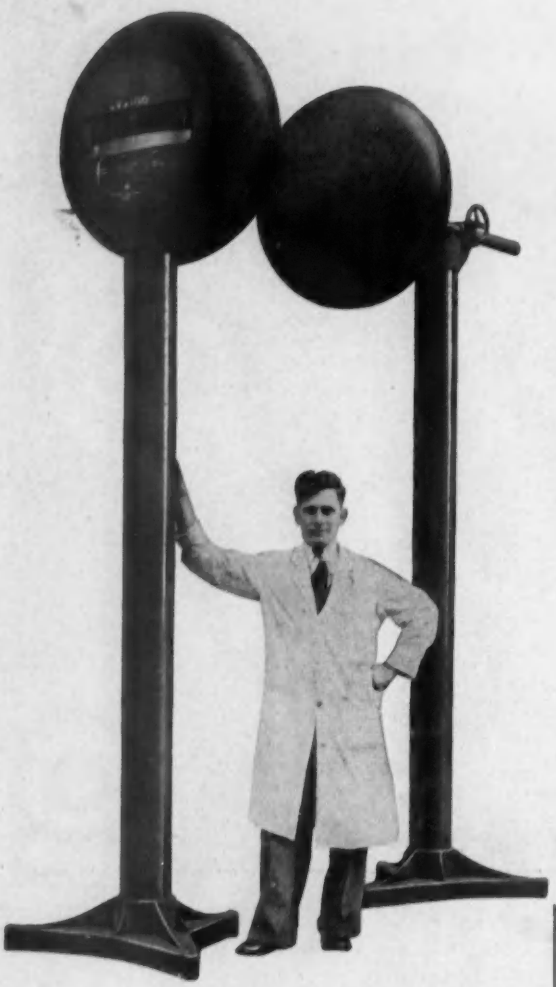
The old Woodhead Tunnel is now closed. The line has been electrified by the BICC Group and runs through a new tunnel, recently opened.

This is typical of the work being carried out by BICC Corrosion Research Organization in their continuous search for better ways of ensuring longer life for BICC products.

BICC

CORROSION RESEARCH

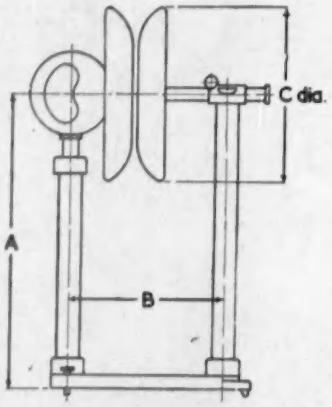
BRITISH INSULATED CALLENDER'S CABLES LIMITED, 21 Bloomsbury Street, London, W.C.1



Electrostatic Voltmeter

MODEL V 500,000 VOLT

TRIPLE RANGE



MODEL	A		B		C	
	ins.	cms.	ins.	cms.	ins.	cms.
I & II	24⅞	64	12	31	10	26
III	39¼	100	19½	50	18	46
IV	39¼	100	25¼	65	20	51
V	77	196	46	117	30	77

RANGES			
Model I (3 ranges)	3,000– 10,000 6,000– 20,000 12,000– 40,000	Model II (3 ranges)	5,000– 15,000 10,000– 30,000 20,000– 60,000
Model III (4 ranges)	5,000– 15,000 10,000– 30,000 20,000– 60,000 40,000–120,000	Model IV (4 ranges) Fig. 1	7,500– 25,000 15,000– 50,000 30,000–100,000 60,000–200,000
Model V (4 ranges)	10,000– 30,000 20,000– 60,000 40,000–120,000 100,000–300,000	Model VI (3 ranges)	30,000–100,000 75,000–250,000 150,000–500,000

All models listed in the table on the right are for use on A.C. or D.C. systems, earthed or unearthed.

All have several ranges and may be dismantled for transport. Special carrying cases can be supplied. Other types are available for switchboard or portable use for voltages down to 750 V.

Send for Catalogue Sheet No. 153E.

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Designers and manufacturers of almost every type of electrical indicating and recording instrument. Specialists in: Speed Recording, Photometry, Process Time Control, Telemetering.

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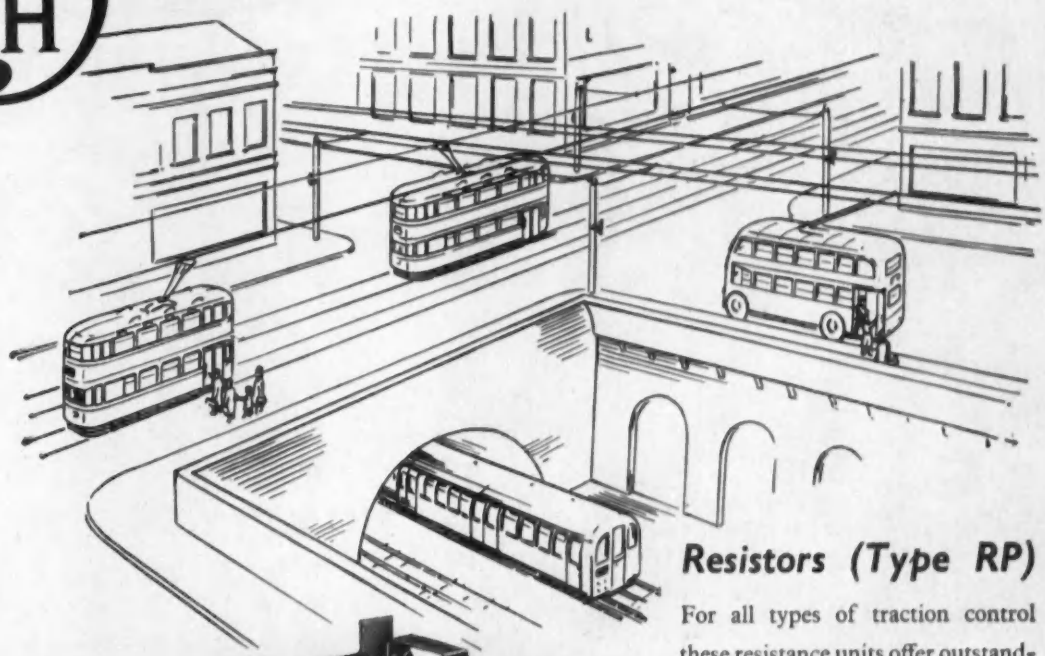
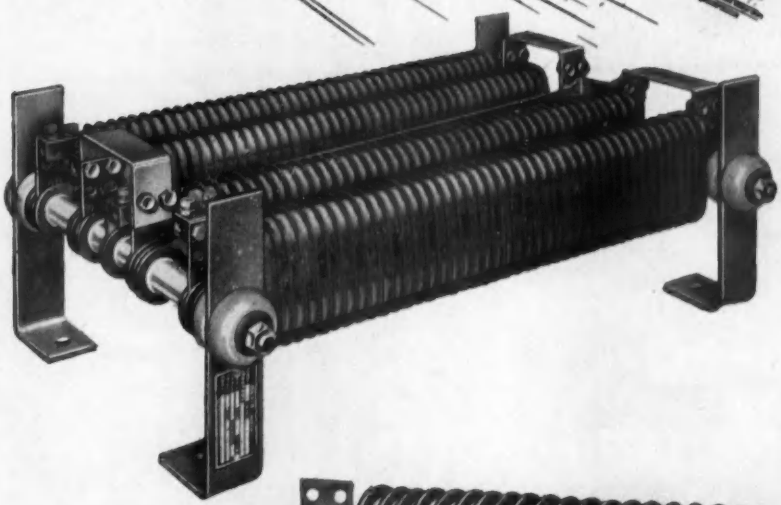
DHB/2163A

B T-H

Electric Traction Equipment

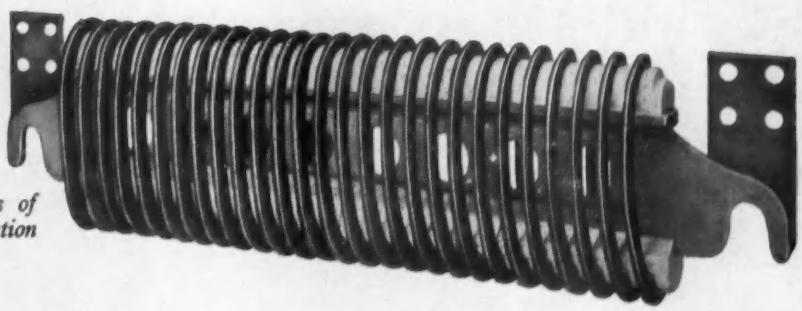




Resistors (Type RP)

For all types of traction control these resistance units offer outstanding advantages.

- Non-corrodible, chromium alloy steel.
- Edgewise-wound strip of liberal section and high specific resistance.
- Mounted on steatite spacers.
- Will withstand heavy overloads and high operating temperatures.



BTH manufacture all types of electric equipment for traction purposes.

THE
BRITISH THOMSON-HOUSTON
COMPANY LIMITED, RUGBY, ENGLAND

Member of the AEI group of companies

A4410

ZENITH

VARIACS with DURATRAK

(REGISTERED TRADE-MARKS)

All VARIAC-DURATRAK Variable Voltage Transformers have a brush track treated in accordance with British Patent No. 693406, which produces a coating of precious metal alloy on the brush track surface, eliminating the possibility of deterioration due to oxydization, and reducing contact resistance.

VARIACS with DURATRAK have longer life, increased overload capacity and maximum economy in maintenance.

Prompt deliveries on all models.

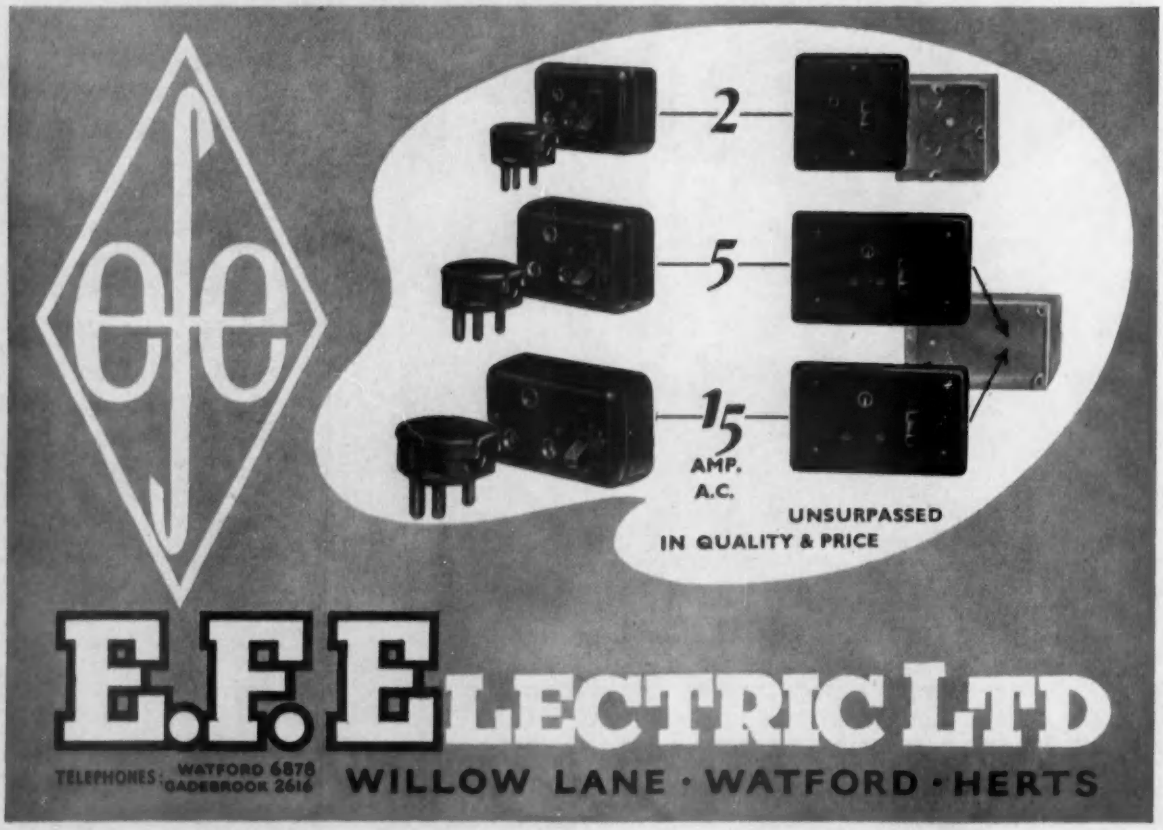
Illustrated brochure free on request.

THE ZENITH ELECTRIC COMPANY LTD.

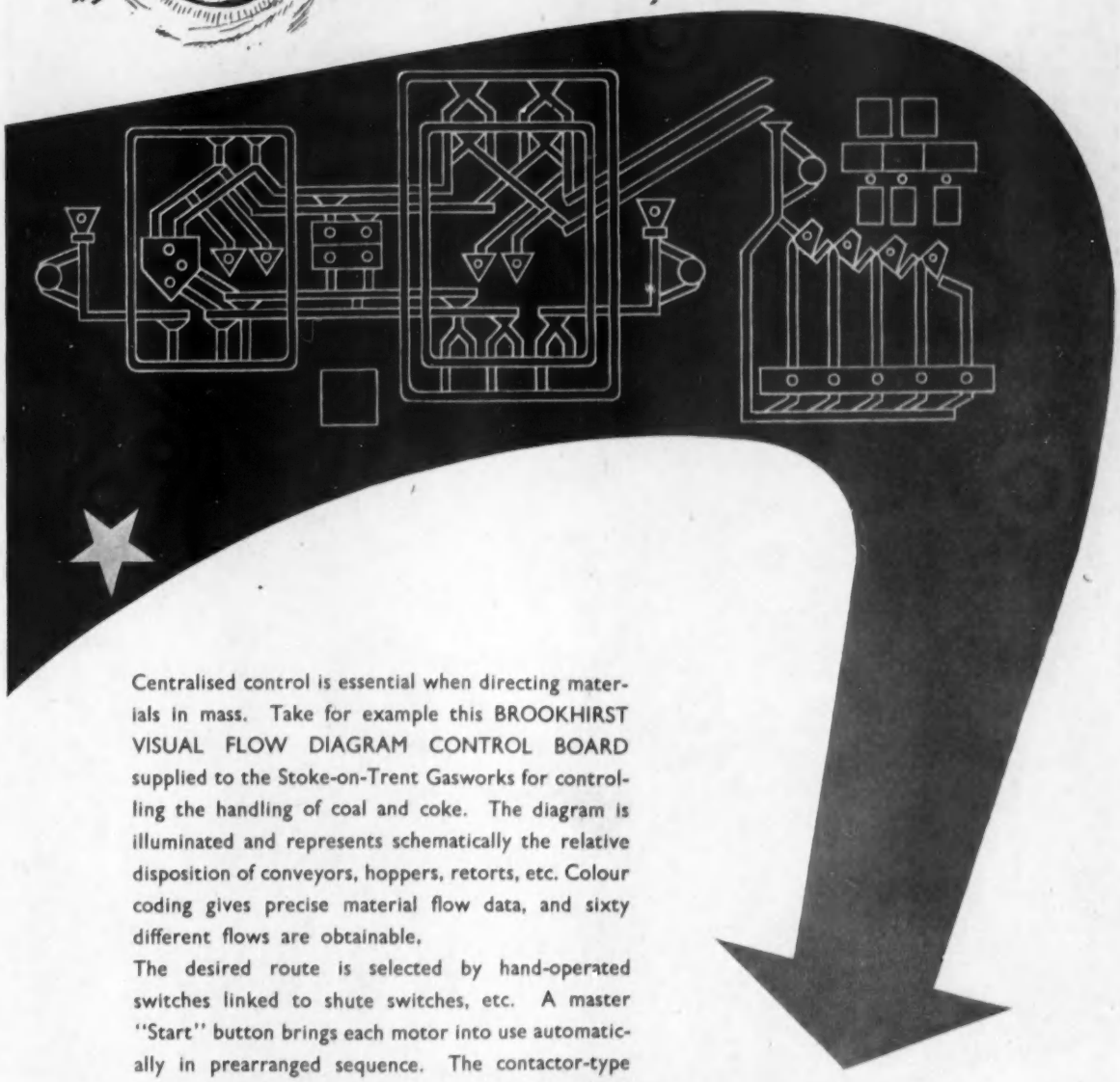
ZENITH WORKS, VILLIERS ROAD
WILLESDEN GREEN, LONDON, N.W.2

Telephone: WILlesden 6581-5 Telegrams: Voltaohm, Norphone, London

R 61



visual flow indication



Centralised control is essential when directing materials in mass. Take for example this BROOKHIRST VISUAL FLOW DIAGRAM CONTROL BOARD supplied to the Stoke-on-Trent Gasworks for controlling the handling of coal and coke. The diagram is illuminated and represents schematically the relative disposition of conveyors, hoppers, retorts, etc. Colour coding gives precise material flow data, and sixty different flows are obtainable.

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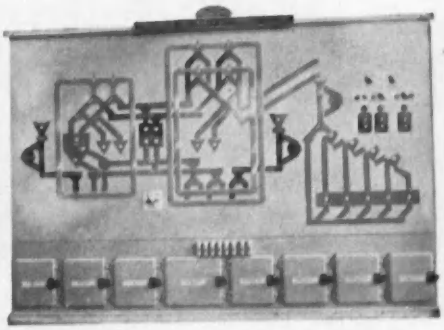

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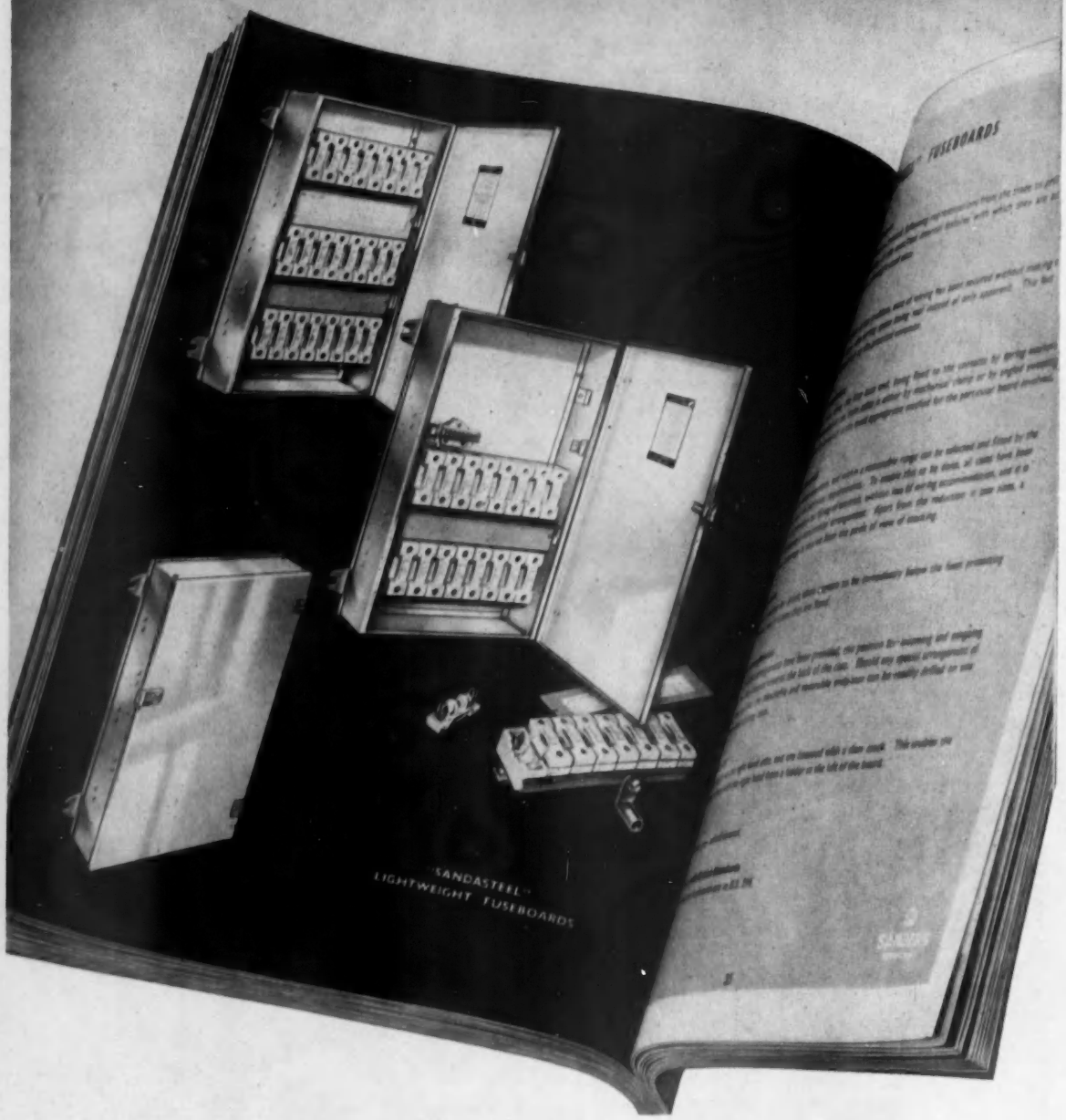

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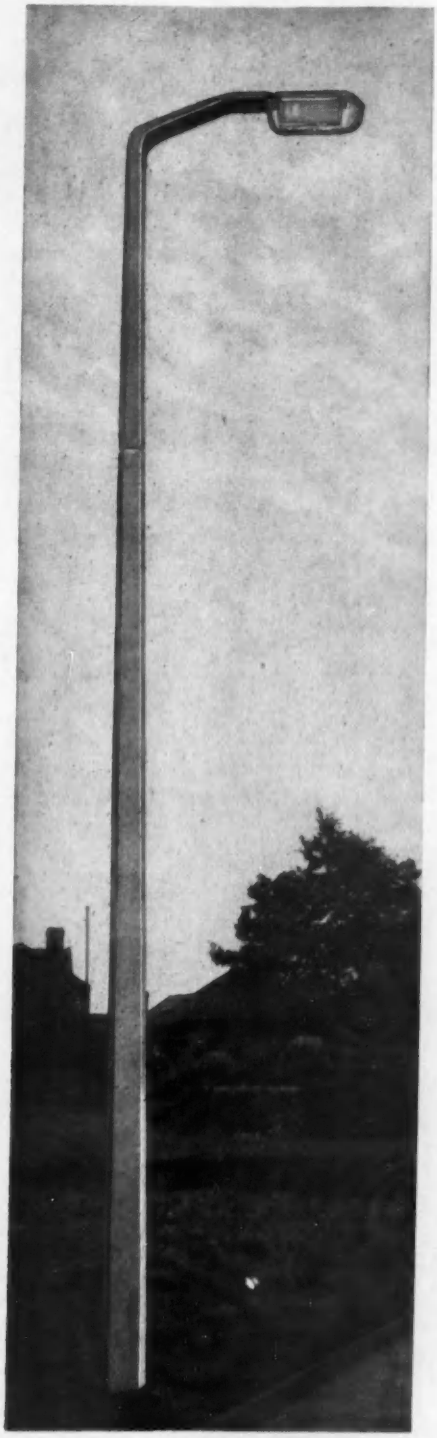

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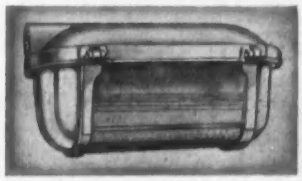

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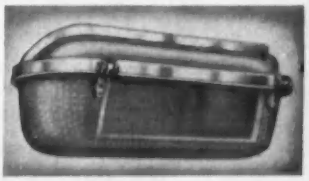

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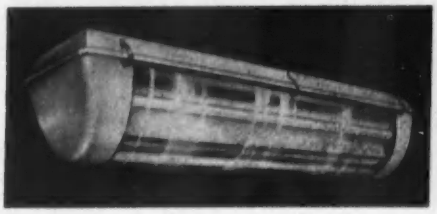

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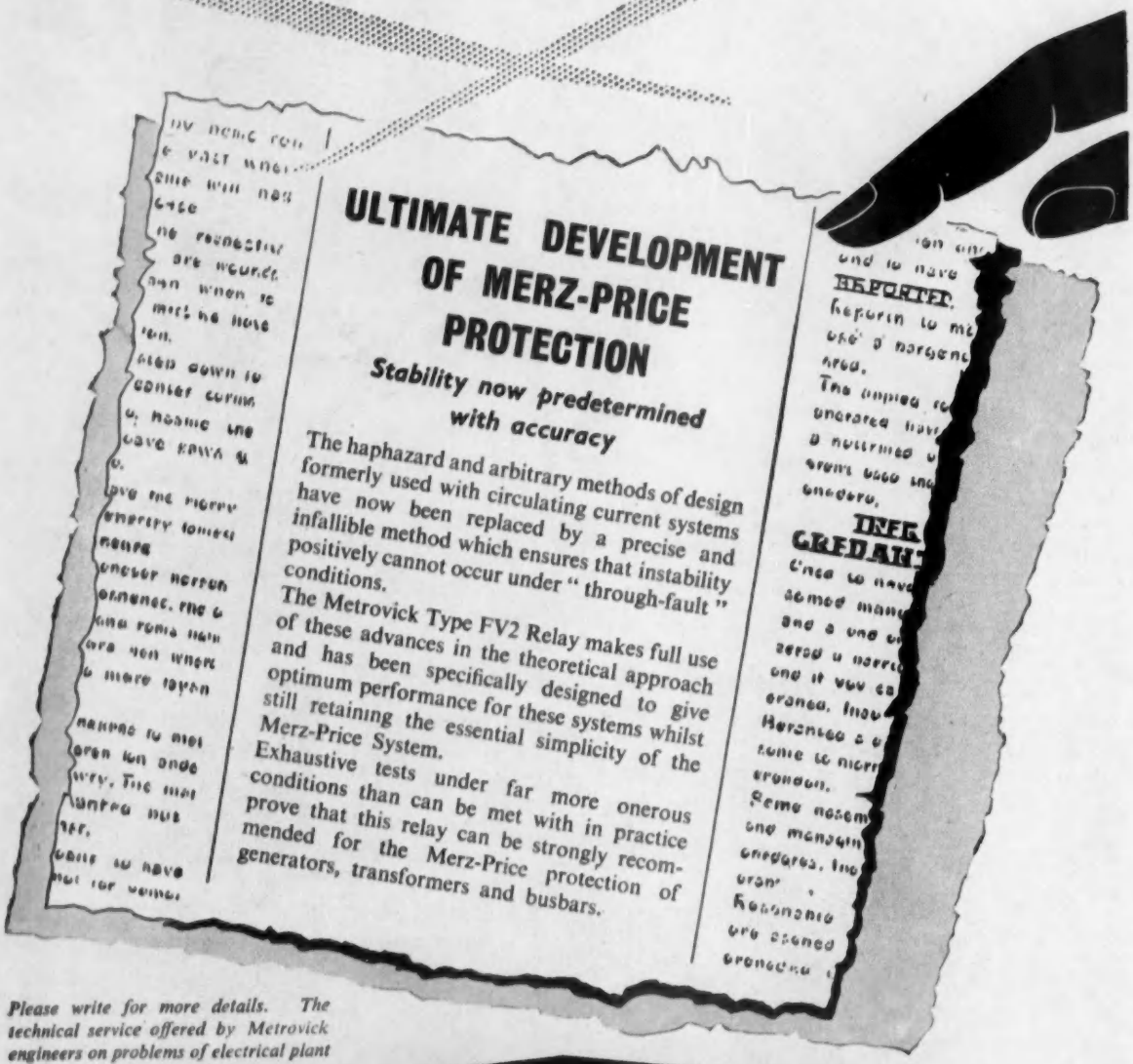

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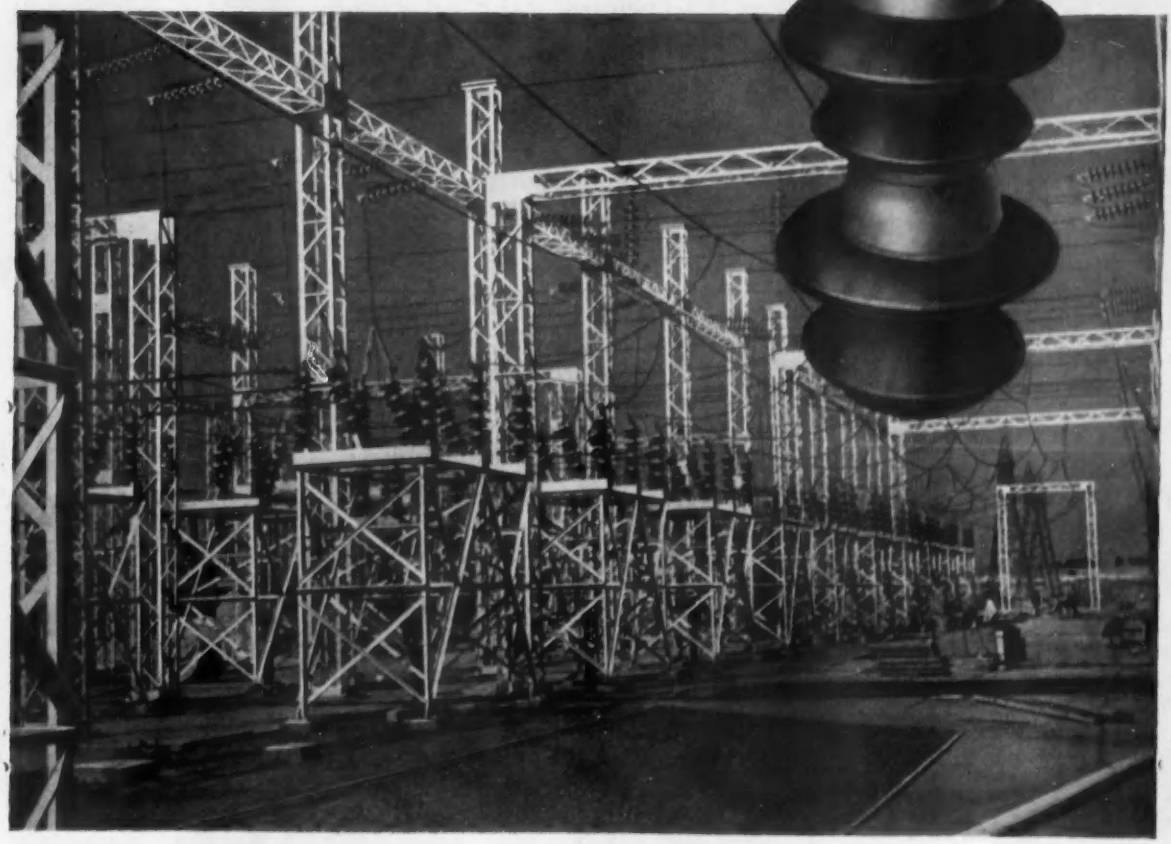

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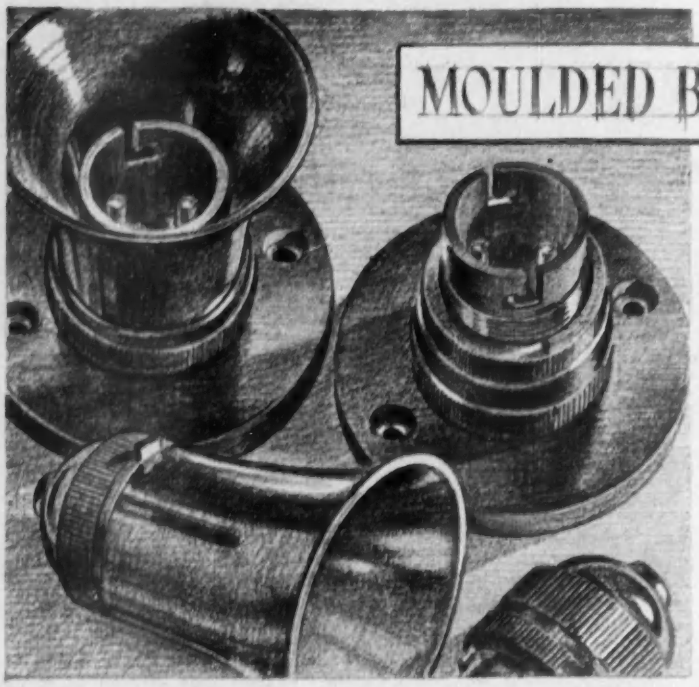

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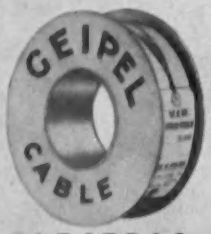

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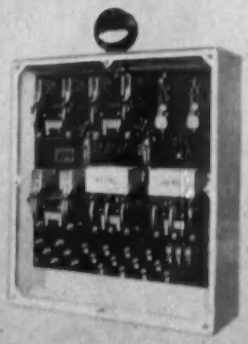

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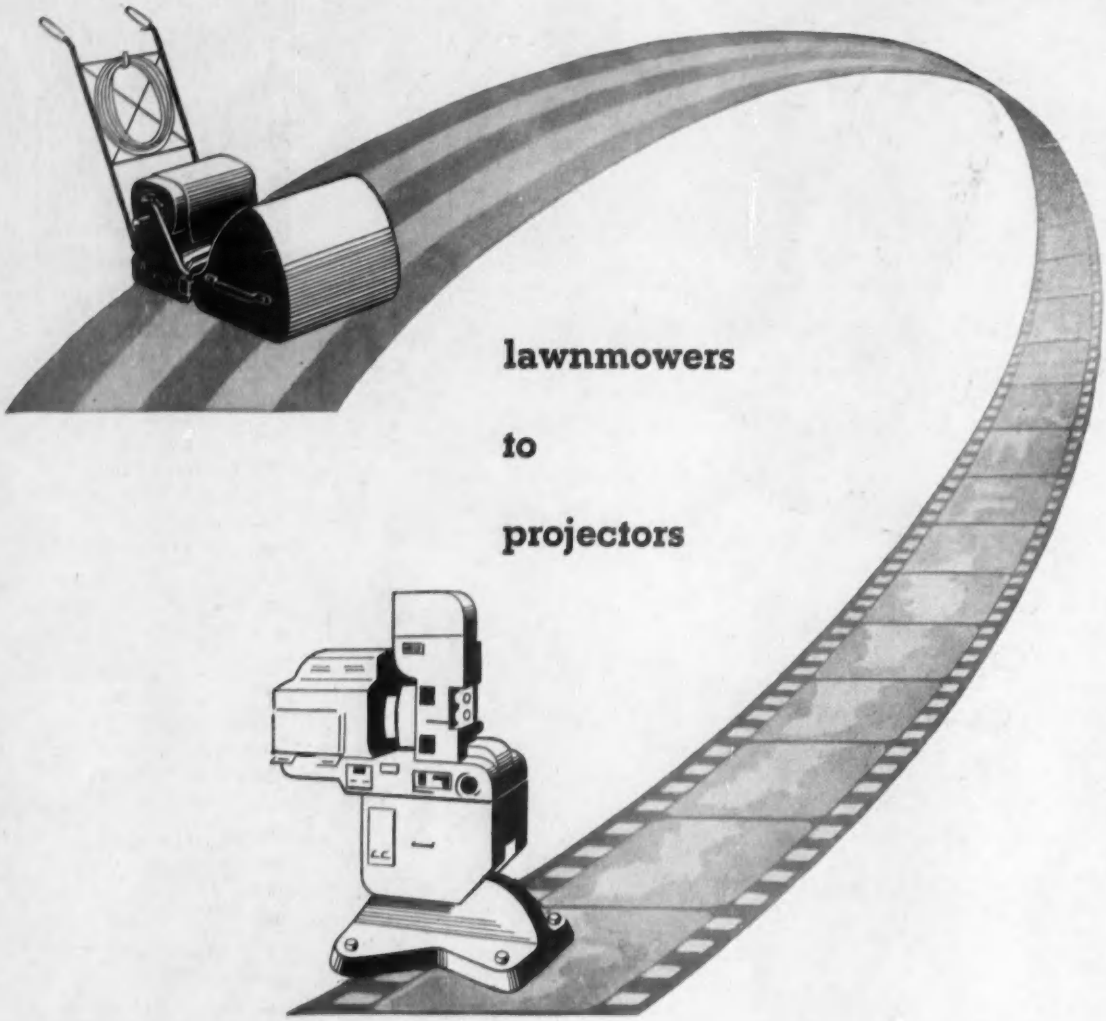

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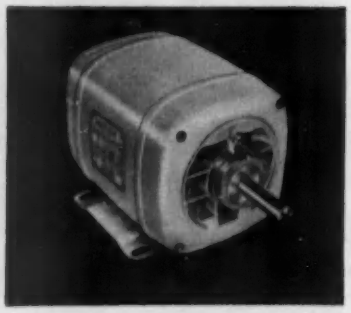

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GENEVA PICTURE

Put engineers together, and they can be relied upon to talk engineering. At Geneva, many hundred engineers and scientists have been brought together for the conference on the peaceful uses of atomic energy, and they are behaving true to type. Sessions are well attended, and there has been far less avoidance of direct answers to questions of fact than might have been expected with a conference on a subject of such commercial importance and with a tradition of security. Moreover, as the sessions have become more technical and the discussions more esoteric, the information usefully presented has improved in quality. "The lid is well off," said Sir John Cockroft, when asked last week his impression of the effectiveness of the conference. Like no other recent meeting of technologists, the Geneva conference is getting down to the complicated heart of the matter. Leading engineers of international standing are rising in public session to ask questions concerning relatively simple matters of fact, more intent on improving their knowledge than on displaying it, as sometimes happens at conferences of this sort. They are receiving answers question by question, with few instances of effective refusal of information. In private, perhaps the most striking example of the spirit that is animating this conference was to be seen early last week in the impressive Russian scientific exhibition. Two Russians were standing pressed against the model of their power station, cheerfully submitting to keen questioning by half a dozen interested Americans about the detailed construction of the station. This, with every appearance of interest and mutual help over the language difficulty. A conference that makes possible such a meeting is achieving a success that must have the most beneficial effects of speeding progress in the genuinely peaceful applications of nuclear energy.

FUSION ENERGY

Most conferences throw up a rumour, hard to track down, but growing in strength. At Geneva, it is the taming of the fusion process of atomic energy release—H-energy it has been popularly christened from its grim familiarity in the hydrogen bomb—that is rumoured to be nearer accomplishment than most people had thought possible. The theoretical possibilities are clear enough. Just as matter can be converted into energy by promoting fission of the heaviest elements, so the same result can be obtained by persuading the lighter elements to fuse together to synthesise heavier

substances. Indeed, the pioneering example of artificial transmutation achieved in the laboratory by Cockroft and Walton was of this type. The practical difficulty is to secure the enormous heat necessary to initiate the fusion process without invoking explosive conditions, and to do this with available materials of construction. But the prize is staggering—energy for all as plentiful as the water in the sea, as Dr Bhaba, the Indian President of the Conference, put it in his opening address. Dr Bhaba, indeed, ventured the opinion that industrial use of the fusion process might be possible in twenty years. Stoking the flame of rumour, an American newspaper has hinted that important advances have been made towards this goal recently in American laboratories. Questioning of British delegates has elicited the fact that work on this problem is receiving active investigation at Harwell. It is, however, probably unrewarding to try to estimate a time scale. The important fact is the effective general agreement that eventually fusion process power stations will be possible; their independence of radioactive fuels will offer abundant energy for the growing demands of the world.

A 100 MILE COAL LINE

Despite the advent of nuclear fuel, coal will for years to come remain the mainspring of power production. This is particularly so in the United States where large and easily mined reserves still exist and it is here that transport of coal, with its vast inland distances, present practical and economic problems. It is thus not unexpected that attention should have been paid to the possibility of hydraulic methods of coal movement. A recent announcement is the proposal to move small coal by pipeline over 108 miles from Georgetown, Ohio, to a station at Eastlake. This is more ambitious than anything attempted hitherto. The longest operating pipeline in Western Europe at the moment is that of 5½ miles which feeds the Emile Huchet power station in Lorraine. Smaller scale experiments are also being carried out by the N.C.B. in this field, but here the major interest is centred on pumping large coal up the pit shaft. The economics of coal transport by pipeline are complex, but it is significant that among the participants of the American pipeline scheme, designed to carry about 1,200,000 tons/annum, are the three railway companies at present engaged in carrying coal to the power station concerned.

MAGNETISM OVER BRITAIN

The byeways of electricity are legion and none is more extensive than that which stems from electrical measurement. Of the many fields of instrumentation, one of which little is heard in electrical circles (since the I.E.E. paper before the war), geological surveying, is in the news. It has been announced that a pilot airborne magnetometer survey is to be made in this country. This technique uses a magnetometer, sensitive to one or two parts per 50,000, which is towed by an aircraft in order to determine the local distribution of the earth's magnetic field. It is a method believed to have been attempted during the war for the detection of submarines and in recent years has come into use as a rapid method of determining rock formation. Its use in this country is perhaps surprising in view of the extent of geological information available through ground surveys, and its application is as much to check the accuracy of the method itself against known data so as to determine whether the method should be extended beyond the 11,000 sq mile survey at present being undertaken. In geological surveying the magnetometer has of course been used for many years as an instrument for surveys at the ground, it is the advance in sensitivity of the instrument used that has made airborne surveys possible.

OPTIMUM CABLE UTILISATION

With steel, lead and copper standing at record prices, increasing concentration is being paid to the optimum utilisation of the current carrying capacity of underground power cables. The limiting factor necessarily remains the operating temperature of the cables and here soil characteristics are already playing an important part. In the future even more precise assessment of operating factors may be required. The recently issued technical report by the E.R.A. on this subject serves to emphasise the difficulty of obtaining accurate measurement of soil thermal resistivity over a specific cable run. Three methods are appraised in considerable detail: the classical "sphere" evaluation which is scarcely suitable for practical field work, and methods using a needle or probe system, on the same fundamental principle; alternatively, laboratory analysis of soil samples. All these methods suffer from defects, either in time taken or restriction of field of application. Above all, seasonal variations of moisture content and local heating from the cable itself are additional factors which can serve to upset test results. Nevertheless, by the use of empirical rules, it is now becoming increasingly possible for the distribution engineer to work more closely to actual requirements of a system.

TRADE SEE-SAW

Until the tightening up of hire purchase credit, electrical appliances appeared to be selling well although not up to last year's figures in which hire purchase relaxations no doubt played a part. The ups and downs of trade seem to be much a matter for Treasury edict these days. This year, however, should provide a good season for fires. The rise in coal prices may have an impact value which causes consumers to seek to extend the interim heating season and to delay using coal fires up to the real cold weather. According to accounts we have received, electric fires are already beginning to move. Storage water heaters also appear to have done well and we have seen reports that a new quarterly record of production was set up in the second three months of this year. On the other hand, cookers sales appear to have eased off. Next week the radio show opens and this year exceptional opportunities are offered with independent television almost ready to start and frequency modulation beginning to receive the recognition that is its due. This field, probably more than any other in the electrical world will be hit by the p.t. restrictions but if groans are well merited at the credit squeeze, it is worth remembering that it is because sales have been running at high levels that it has been applied.

Meteor

Trends in Design of Insulation Systems

BY W. J. RENWICK*

IN recent years the conditions imposed on electrical equipment have become much more severe. On the one hand system voltages have steadily risen, and on the other hand equipment is now used under extreme conditions both of temperature and humidity, and at the same time the size of the equipment in many cases has had to be reduced. It is the purpose of this article to trace how developments in insulating materials and in the design and processing of insulation have helped to make this possible.

Of the factors that control change in the use of insulation, the discovery of new materials and the improvement of original types appear to predominate. A notable example of the first is the change from gutta-percha to polythene in the insulation of submarine telegraph cables. It was early in the 1850's that gutta-percha was successfully used in this way, and it was without a rival until the discovery in 1933 by Imperial Chemical Industries Limited of the material polythene, a thermo-plastic like gutta-percha, but immensely superior to it in high-frequency characteristics and resistance to water, and having a much higher softening point. By 1939 polythene had been brought into use as the insulant for radar equipment cables, and at the same time an experimental length of submarine cable had been made.[1] Its value today for high-frequency working generally at temperatures up to 80° C is universally known.

The fact that polythene was, in the first instance, the incidental result of a research project with ethylene gas at very high pressures, without expectation of an industrial product, underlines an important consideration, namely, the probability that research may, at any time, yield a new material which is economical to produce and with properties to meet some of the engineers' urgent requirements. Polythene is of particular interest at present on account of the impending laying of a submarine telephone cable across the Atlantic.[1, 2]

The effect of the gradual improvement of existing materials and processing techniques can be seen in the history of the high-voltage power cable. It was in 1889 that Ferranti, in transmitting power at 10 kV from the Deptford generating station to transformers in the London area, inaugurated the era of oiled-paper insulation for underground power cables by employing concentric conductors insulated with sulphite-process woodpulp-paper impregnated with a black bituminous type compound.[3] Between then and now the fruits of research and development both by suppliers of materials and cable manufacturers have improved this type of insulation to such an extent that oil-filled cable for 301 kV has been made in this country and is now in successful operation in Canada. It is believed that this represents the highest voltage for which oil-filled cable has been manufactured in this country. A 380 kV cable of the same type, made by a Swedish company, is in operation in Sweden. No other material has challenged the use of paper for this purpose.

General Applications—Low Voltage

In the field of general application, developments over the last thirty years have raised the level of performance of insulation systems, notably in respect of thermal endurance —a characteristic that assumes increasing importance from the fact that for low-voltage equipment the trend is in the development of systems whereby thermal endurance may be increased and space factor improved. The major field of application of the newer materials has therefore been in low-voltage equipment, where they have been used to give long life under conditions of high temperature and high humidity, and corrosive atmospheres. The importance of thermal endurance has long been recognised in the classification drawn up by the International Electrotechnical Commission for different kinds of insulation.[4]

Class 'O': Cotton, silk, paper and similar organic materials when neither impregnated nor immersed in oil (maximum operating temperature, 90° C).

Class 'A': Cotton, silk, paper and similar organic materials when impregnated or immersed in oil; also the enamel of enamelled wire (maximum operating temperature 105° C).

Class 'B': Mica and asbestos and similar inorganic materials, in built-up form combined with binding cement (maximum operating temperature 130° C).

Class 'C': Mica, without binding cement, porcelain, glass, quartz, and other similar materials (for operating temperatures greater than 180° C).

The relatively high heat-resisting silicone materials have been recognised by the American Institute of Electrical Engineers,[5] though not as yet by this country, in a further class, designated Class H, which is as follows:

Class 'H': Mica, asbestos, fibreglass and similar inorganic materials in built-up form with binding substances composed of silicone compounds, or materials with equivalent properties; (2) silicone compounds in rubbery or resinous forms, or materials with equivalent properties (maximum operating temperature 180° C).

* Mr Renwick is head of Insulation Group, Witton Laboratories, The General Electric Co., Ltd. Fig. 1 above shows a silicone-insulated motor running in water.

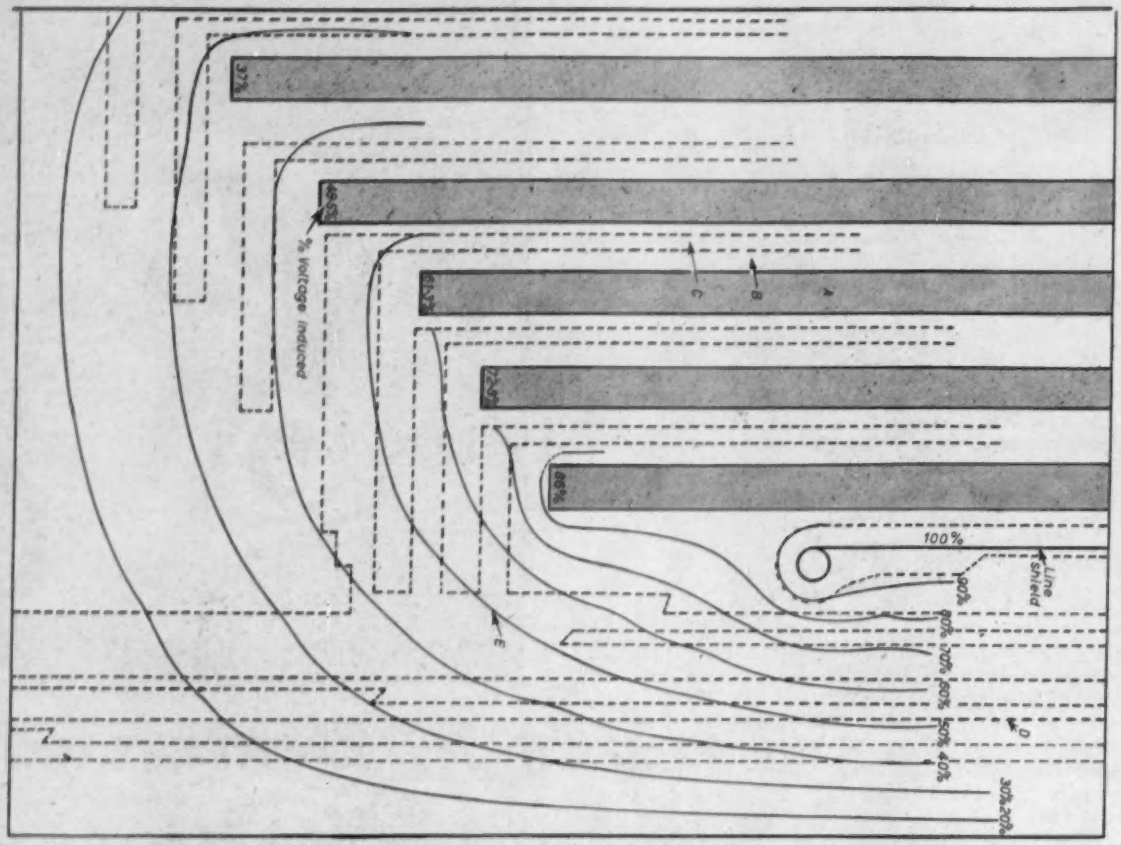


Fig. 2 (above). Layer winding for 300 kV class of transformer. First position of line shield (induced voltage conditions)

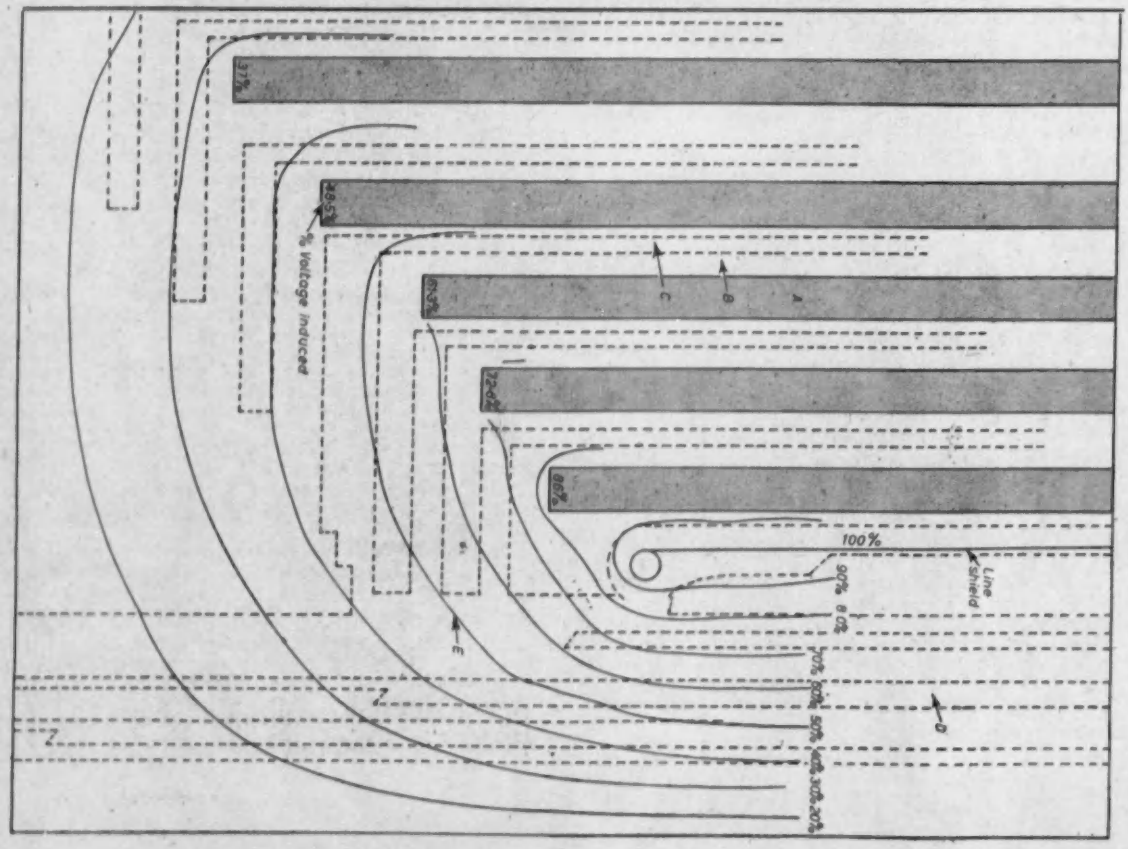


Fig. 3 (below). Layer winding for 300 kV class of transformer. Second position of line shield (induced voltage conditions)

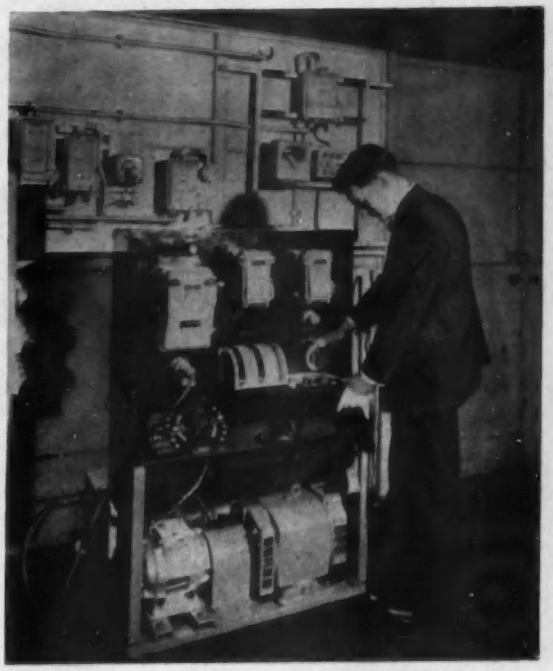
Among the new materials, the semi-inorganic silicone varnishes, elastomers and fluids were at once recognised as unique when they first appeared in this country some ten years ago. Much experimental work since, and the growing number of such materials becoming available from insulation manufacturers in this country, together with instances of their use,[6] have greatly increased their interest. Silicone elastomer sleeving is competitive with conventional high-grade materials, and elastomer-glass fibre combinations have become available in convenient thicknesses, suitable for basic high-temperature insulation. Moreover, the possibility of greatly increasing the temperature range of wire enamel, as such, has been created by the production of a silicone-based material of this type.

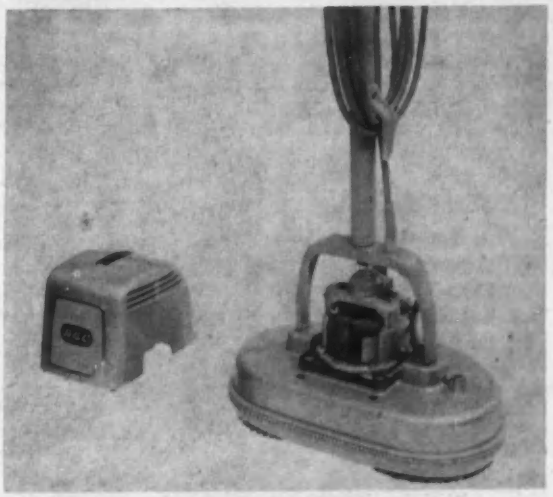
Notable new organic materials are polyethylene terephthalate (Terylene), a synthetic fibre produced in 1941, and which, from the evidence of experimental work, could be placed in Class 'B'; and the epoxy resins, which are used in conjunction with hardening agents and inorganic fillers and which, by virtue of the fact that no volatile material is formed in curing, may be cast into open moulds. Both hot and cold setting types are available, but generally the hot-setting have the better high temperature performance. For low-voltage applications such as encasing small electrical components, the resin may be cast into open moulds under atmospheric conditions, but for higher-voltage applications casting at low pressure would appear to be essential.

Work on New Materials

In view of these and of other new materials it will be apparent that the I.E.C. Classifications, particularly 'A' and 'B', impose a severe limit on the designer so that full advantage cannot be taken of many of them. A great deal of work, in many countries, is therefore being devoted to the formulation of tests whereby insulation systems as a whole may be evaluated and permissible operating temperatures established for the systems in the light of their particular applications—for example in motors, transformers, and so on.

A beginning in this direction has been made, but much remains to be done. For example, temperature/life relationships for the widely used vinyl-acetal based wire enamel as part of a system bonded by oil-modified phenolic resin require to be established. Again, evaluation of silicone-based wire enamel as part both of Class 'B' and (U.S.A.) Class 'H' systems, and of epoxy resin based enamel as part of a Class 'B' system should proceed. Such evaluations are conveniently made on small motors at temperatures likely to produce marked mechanical degradation of the systems in relatively short times. It is, of course, recognised that the results will have relevance for certain classes of rotating machines only; but as this application is an extremely large and onerous one, the method employing motors is perhaps the most widely used at the present time. There are also several alternative methods for comparing types of insulation, including winding a number of coils having different insulation on one armature; winding a number of fractional horsepower motors, each with a different insulation system and testing simultaneously; and also the American "motorette" method, which employs static sections, each comprising a pair of slots with two coil sides per slot, and which may be temperature-cycled, humidified, and mechanically vibrated in an ordered sequence.





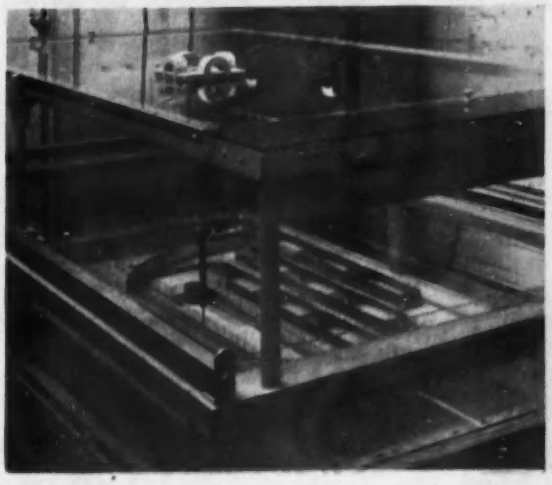


Fig. 4 (top). Motor-generator set for thermal endurance tests of insulation systems

Fig. 5 (centre). Floor polisher incorporating double insulation

Fig. 6 (bottom). Electrolytic tank containing model of part of high voltage winding of layer type transformer

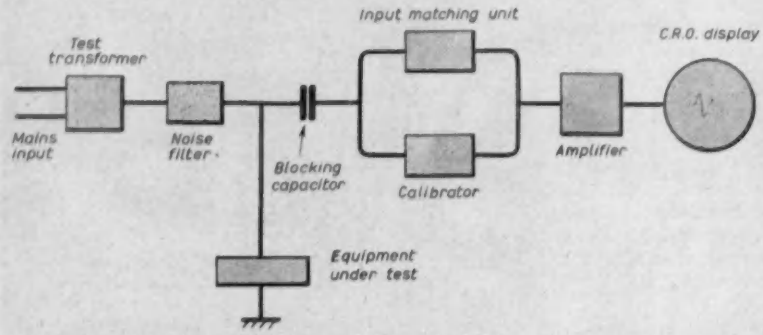


Fig. 7. Block diagram of discharge detector (as by Hivolt Ltd.)

Evaluating Insulation

Fig. 4 illustrates a small portable motor-generator set designed for evaluating insulating systems. The test machine is a 3-phase squirrel-cage induction motor (which would be rated at 1 h.p. at 400 V, 50 cycles, in Class 'A' materials) and its stator carries the insulation system to be evaluated. It is direct-coupled to a 3 kW, 500-volt, shunt-wound d.c. generator with field separately excited from the a.c. supply through a rectifier. In operation the generator feeds into a resistance bank located behind the control panel. For convenience the load is arranged to be switched-in in sections, final adjustments being by field control.

Temperature measurements of the test system are made by thermocouples, one in each of three slots, one in each end winding, and one in the stator iron. Having decided on a maximum temperature for the system under test, the loading is adjusted until one of the thermocouples in the winding registers this value, which is thereafter maintained approximately constant during running times.

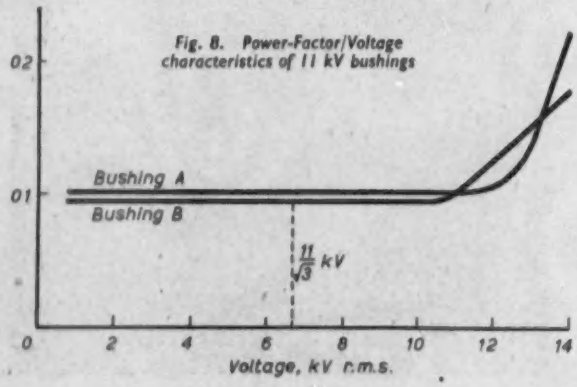
In operation the motor runs for 8 hours during the day, followed by overnight cooling, a cycle that imposes severe mechanical stresses on the insulation. At intervals of 300 hours running time the stator is exposed to a saturated atmosphere at ambient temperature for 48 hours prior to the measurement of insulation resistance between windings and iron. This procedure continues until such time as falling insulation resistance with exposure to damp conditions indicates that the insulation system has begun to fail. How long the evaluation shall continue after this point is determined by visual examination of the insulation and by overvoltage tests.

High Temperature Insulants

The results of evaluations of systems based on mica, glass fibre, and silicone resins by this method have been reported elsewhere.[7] Together with the characteristics of individual materials, they led to the conclusion that whereas a maximum continuous operating temperature of 180° C is reasonable for silicone-varnished glass fibre or asbestos, and for silicone elastomer, major insulation, such as silicone resin bonded glass-baked mica, could be allowed to operate at a maximum temperature of 200° C.

Incidentally, these evaluations confirmed an important feature of a silicone resin bonded system, namely, that of rapid natural drying from the wet condition to regain high values of insulation resistance. Fig. 1 shows a silicone-insulated fractional horsepower motor running in water in a test designed to assess one aspect of the moisture resistance of the insulation.

With regard to the insulating of domestic appliances a present trend should be noted, which involves the principle of double-insulation recently introduced as an alternative to earthing the metal parts. In effect it means that the metal parts that carry the motor windings are not accessible to the user of the appliance, but are separated from accessible parts by a barrier of solid insulation—hence the name double-insulation. In action it would protect the user of the appliance from any risk incidental to the failure of any part of the motor insulation system, as the possibility of both this system and the solid barrier being faulty at the same time is very remote indeed. Fig. 5 illustrates a floor polisher with the cover removed to show both the motor (functional) insulation, and the protective insulation.



High-Voltage Equipment

For large, high-voltage machines, continuity of service over many years has established the inherent soundness of a high-voltage insulation system based on mica, paper and glass fibre with a bituminous bond, heat and pressure consolidated under carefully controlled conditions. However, new developments in materials and application techniques are being continually examined to assess their possible advantages over existing materials.

The high outputs of present day machines, which are being designed for rating up to 200 MW, have set problems which are due primarily to the limiting factor of machine dimensions. Many of these problems are concerned with cooling requirements, and in their solution hydrogen at different degrees of pressures is being employed as the cooling medium. Increased generator voltage may also be regarded as a factor in the solution of these problems. In order, therefore, to design insulation systems to meet high gas pressure and increased voltage, considerable experimental data bearing on such conditions are being established.

The requirement of high output has made rotor operating conditions more onerous and in view of this and of the new techniques in rotor cooling, certain modifications to the present insulation systems are desirable. In effecting them new heat-resisting materials having good electrical and mechanical properties are being drawn into service.

Stress Analysis

In the field of high-voltage oil-immersed power transformers, none of the newer materials has reached a sufficient degree of perfection to be used as main insulation. The increased operating voltages have, therefore, been accommodated by careful design using well-established materials. One aspect of this work has been the examination of the stress distribution in the materials. In

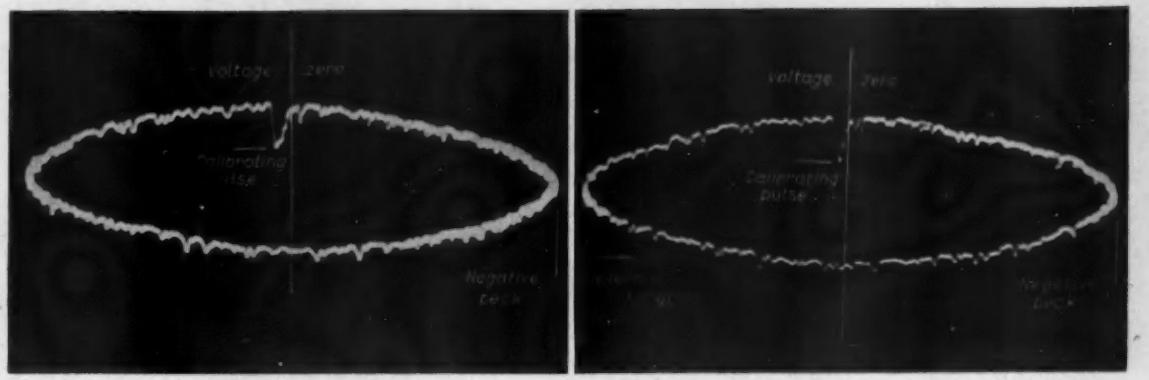


Fig. 9. Oscillogram of bushing "A" discharge-free at working voltage, 11/3 kV. Fig. 10. Oscillogram of bushing "B" showing discharge at working voltage, 11/ 3 kV

doing this the principle of analogy, as utilised in the technique of the electrolytic tank, has enabled complex electric field problems to be tackled with confidence, and, as the results have shown, with success.

Briefly, and referring to Fig. 6, which illustrates the tank with a model in position, the technique enables electric field phenomena such as occur in high-voltage power transformers, particularly under induced voltage and impulse test conditions, to be examined by means of relatively simple model constructions of the actual windings and associated electrodes built on an insulating base, which has channels of different depths cut in it. Such models, when immersed in an electrolyte, usually tap water, vary the depth of the electrolyte in accordance with the differences in the permittivity of the actual insulation—for example, paper and oil. To make the transition from one depth to another depth the boundary is marked out at one-eighth in. intervals by plated brass pins, which, being immersed to the full depth of the electrolyte, prevent the current from stream-lining over the boundary. A low voltage at 1,000 cycles/sec. is applied to the model electrodes, and the distribution of potential in the electrolyte between them is explored by means of a probe. It can be shown[8] that the potential distribution in the electrolyte due to current flow will then be similar to the electrostatic field distribution in the actual winding. In other words, the capacitive distribution in the equipment is simulated in the resistive division of the electrolyte.

It should be noted (see Fig. 6) that the tank supporting frame may be tilted through an angle to make a flat model simulate a wedge-shaped one, which is essential when the equipment represented has rotational symmetry about its centre line: further, that the platinum wire probe is attached to an assembly of magnets* grouped on either side of the transparent plotting table. The attraction between the magnets constrains the under set to follow smoothly any movement of the upper.

The tank is being extensively used for transformers of the 300 kV class. Fig. 6 shows, within the tank, an enlarged model assembly designed for the study of one end of the high voltage layer winding of such a transformer under induced voltage conditions. The matter under investigation is the influence of the position of the line shield on the stress concentration at the inner edge of the outermost layer. It can be seen from Figs. 2 and 3, which show preliminary plots of the potential distribution in the tank for two positions of the line shield, that the stress concentration at the end of the line shield and inner edge of the outermost layer are interdependent.

By developing a method employing a three-dimensional model it has been possible to use the tank for studying problems related to the positioning of bushings in switchgear and transformers.

Discharges in Voids

A main reason why many of the new materials have found but little application in high-voltage engineering is tied up with the fact, that a very high standard is required in their manufacture to prevent gas pockets being entrapped in the structure. Discharges in such pockets can lead to eventual failure of equipment and the necessary manufacturing experience to reduce the size of these pockets so that they become unimportant can only be built up with time.

In this connection the development of new materials and designs is aided by methods of detecting discharges and to this end a recent method developed by the Electrical Research Association[9] may—as experience is gained with it—prove of considerable value as it provides a degree of sensitivity hitherto only obtainable in industrial laboratories by special means, and with difficulty. In this method, increasing voltage is applied to the equipment under test, which is connected to form part of a circuit tuned to a suitable frequency (Fig. 7). When the corona-inception voltage (C.I.V.) is reached high-frequency discharges take place in the equipment, which then behaves as a source of high-frequency pulses which can be amplified and displayed on a cathode ray tube, together with a variable calibration pulse. The C.I.V. and discharge intensity can, therefore, be measured simultaneously. Additionally, the appearance of the dischargers can provide information about their source: for example, it is possible to identify discharges in voids bounded by insulation and in those adjacent to metallic surfaces.

The peculiar value of the method is illustrated by reference to Figs. 8, 9, and 10. Figs. 9 and 10 show elliptical traces obtained by this method from two similar 11 kV S.R.B.P. bushings "A" and "B," one of which, "B," was known to have a fault due to accidental local overheating of the central metal tube. Figs. 8 and 9 indicate that there were no detectable discharges in bushing "A" at working voltage 11/ 3 kV, by either the Schering bridge or detector methods, whereas Fig. 10 shows clearly continuous discharges at working voltage in bushing "B" which are not disclosed by the power-factor/voltage test. These results emphasise the point at issue as between the two methods of test, namely, the significance for the service life of bushings of low-intensity discharges that can be readily detected by one method, but not by the other. Only experience with the "detector" method on both in-

* Due to Professor E. Bradshaw, College of Technology, Manchester.

stalled and new equipment, together with the findings of research on the effects of such discharges on typical insulating materials, can provide a body of knowledge likely to resolve the issue.

There is, in principle, no difficulty in applying the "detector" method to the highest voltage bushings in either S.R.B.P. or oil-impregnated paper provided precautions are taken to render the high-voltage source discharge-free in the working range, or effectively so by means of efficient filtering, and that a similar discharge-free blocking capacitor be used.

Conclusion

Having regard to the wide range of applications and the increasing variety of insulating materials available, the electrical engineer is faced with extremely complex decisions in selecting the most appropriate form of insulation for a given equipment. In this connection the determining factors are reliability and economics. He will be loth to discard well-tried and established materials for marginal improvements, particularly as capital expenditure may be required to cover the cost of new processing equipment. Nevertheless, some of the advances have been so significant that older materials are rapidly giving place to new kinds, leading to more reliable and more economic products, and in some cases to cheaper methods of manufacture.

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READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Earthing Lighting Fittings

IT may be of interest to your correspondents who have recently been writing on the subject of earthing of lighting fittings, to know that this question has been discussed and carefully considered by the technical members of my Association.

In May, 1953, a report was prepared on the interpretation of B.S. 816 and of the I.E.E. Wiring Regulations in regard to the earthing of decorative and commercial lighting fittings, and methods of providing earth connections where these were necessary, having regard to the different methods of suspension, including chains, cords, ball sockets, etc.

The conclusion reached by my Technical Committee as a result of this report, was that in their opinion, provision for earthing should be made by the manufacturer on the main metal part of a decorative or commercial lighting fitting which is liable to be touched when being re-lamped and which might become alive from faulty wiring.

All member-companies of my Association manufacturing decorative and commercial lighting fittings were advised of this matter accordingly.

J. H. Campion,
Secretary,
Electric Light Fittings Association.

"Improved" Fires

THERE is no single "improved" type of solid fuel domestic grate, and your remarks should have been confined to the inset grate (also known as the continuous burning fire and the coke grate). Both the Fuel Research Station and ourselves have carried out tests to compare the inset grate with the older stool-bottom grate, and we agree there is little difference in efficiency, but that the ability of the inset grate to burn a wider range of fuels, including coke, is, of course, an important advantage.

You have, however, ignored a more recent type of "improved" open fire, namely the freestanding convector fire with restricted throat, suitable designs of which have a substantially higher efficiency. The latter appliance has been shown (J. Inst. Fuel, March 1955, pp. 123-132) to have a room heating efficiency 60-70 per cent greater than that of the ordinary fires you mention in your editorial, and B.C.U.R.A. has shown by field tests in actual houses that this higher efficiency results in both fuel saving and increased comfort.

This is confirmed by laboratory tests, from which it may be calculated that an output efficiency of about 36% with coal, and 46% with coke is attained with these freestanding convector fires, compared with about 25% and 35% respectively for the inset open fire fitted in an ordinary fireback and tiled surround. The room heating efficiencies of the two types of appliance are separated by an even bigger margin, due to the fact that the freestanding convector fire with restricted throat does not waste heat by excessive air flow up the chimney.

It is unfortunate that you did not read all the recently published papers on the subject before writing your editorial, since your conclusions have in consequence been somewhat misleading. I should be obliged if you would be so good as to rectify the position by publishing the above facts.

S. A. Burke,
Superintendent.
Domestic Appliance Laboratories.
B.C.U.R.A.

[*"Meteor" is not unaware of the efficiencies claimed for the "recent improved" (freestanding) fires and for those users who do not find their appearance objectionable on æsthetic grounds, they may be excellent. However, remembering some of the earlier claims for the "older improved" (continuous burning) fires which, as Mr Burke tacitly agrees, are now found to be unduly optimistic, there appears reasonable justification for caution in accepting efficiency claims from the solid fuel industry.—Ed.*]

around the trade

by Peregrin

LIKE many electrical men I spent a holiday on the Continent this year, and although I am not in favour of a busman's holiday I instinctively keep an eye open for anything of electrical interest. In previous years this habit has tended to keep me awake at night, in readiness to escape from the almost inevitable fire caused by "the fusing of an electric wire," for many of us are familiar with the wiring "system" in most hotels. It consists simply of twin-twisted flex, supported by widely-spaced cleats, and disappearing through ceilings and walls, on the way, no doubt, to innumerable dry joints decorated with lashings of tape. This year, however, I found a distinct advance in wiring, in some parts of France and Italy. Plastic-covered "Figure 8" flex is used, secured by panel pins driven between the conductors, and now and again even a regulation insulated surface junction box is visible. One cannot help wondering why we worry so much about I.E.E. Regulations, National Inspection Councils and all that, in our eternal quest for perfection. Our Continental colleagues seem to manage very well without such safeguards, for we are not constantly reading of conflagrations and death-rolls due to electrical fires.

Shaving Facilities

Continental hotels, especially those in Switzerland, offer one small electrical service which could well be copied here. They provide a socket for an electric shaver, in a conspicuous position near the bedroom mirror. This may be to discourage the shaver from using the bathroom, for unless you have a private bath attached to your room, you may as well give up the idea, as all the other bathrooms are kept locked and no one seems to have the key. Perhaps in Britain we must provide the dry shavers before the sockets, and that is a matter for electrical retailers, for there is immense scope for them in that direction. There are more than twenty models from which to choose, at prices from £4 to £14, but the popular established makes cost £7 to £9. The time has long passed when the idea of dry shaving had to be sold. Most men covet one or at least have no prejudice against them, so it is only a question of persuading a man—or his wife—to choose the make and model. The retailer must, however, take his own medicine. He should become a regular dry shaver himself, which is not at all difficult, and offer facilities for personal demonstration, for in this respect he cannot fall back on the ever-willing wholesaler. Although wholesalers, up-to-date as usual, stock and display a bewildering range of electric shavers, they cannot be expected to welcome a queue of retail customers eager to experiment with a brand new instrument.

But, as I have often stressed in these notes, it is important for the electrical dealer to make hay while the sun shines, or he will see the business drifting to hairdressers, chemists and multiple stores. It is estimated that there are about twelve million potential prospects for dry shaving in this country, so there are plenty to go at.

Lamps to Sell

This month, while pantomimes are being rehearsed and Christmas cards being printed, the lamp makers are busy preparing for the next lighting season, and we all know how well they do it. In a few weeks we shall receive the new lamp lists, a supply of leaflets, and details of the new season sales "aids," all for no cost or effort on our part. Is this generosity worth while and is it properly appreciated? No doubt the lamp manufacturers often ruefully ask themselves that. They certainly take their full share in the active promotion of lamp sales, and so do the wholesalers, with their immense stock and quick delivery. There only remains one section of the partnership—the retailers, and one cannot help wondering if they, or a great many of them, make the little effort expected of them. There is a vast and increasing trade in lamps, and there is a lot of money to be made at it. Consumers do not have to be encouraged or tempted to buy lamps. They buy them because they need them, and when a dealer goes out for a lamp order the work has already been done for him by the lamp makers' publicity.

Replacement Economics

Admittedly there is not much profit in the sale of a 60 W lamp, and those fancy devices on retailers' counters for demonstrating different types of lamps, are amusing but unrewarding. Lamp selling is bigger than that, and the astute dealer should try for the big fish—the industrial and commercial users, the people who really use lamps. He should also encourage what the Lighting Bureau calls "Group Replacement," which means simply that all lamps in a large building should be discarded and replaced at one go, when a few begin to fail, regardless of the condition of the remainder. When the first few fail, it is a warning sign, as it is fairly certain that the rest are nearing the end of their useful light and in any case becoming extravagant consumers. The factors to be considered are reduction in light, increase in current and the labour cost of replacement.

The first two are fairly well known and understood, but the labour factor is often ignored. When a lamp has to be replaced during working hours, possibly with the use of a ladder or other tackle, the man's time has to be added to the cost of the inconvenience, and the possible loss of production or trade through a temporary hold-up. Also, when lamps are changed individually as they fail, there is no systematic record of their life and performance. It is much more efficient from all points of view, and less expensive in the long run, to replace all lamps at one operation, ruthlessly scrapping those still working, and to do the job outside working hours. This means an order for several hundred lamps. There are many such orders and they are there for the seeking. Better still, the lamps will need replacing again next September, and so it goes on.

BY ten-thirty on Monday morning of last week the spaciously appointed blue-carpeted assembly hall of the Palais des Nations in Geneva was filled with the delegates of some 80 countries, gathered for the opening session of the Conference on the Peaceful Uses of Atomic Energy. The Conference had got away to a good start on the Sunday when the scientific and commercial exhibitions were opened, and some revelations made about new construction plans.

Proceedings began with a welcome from the President of the Swiss Confederation, Mr Max Petitpierre, and from the Secretary-General of U.N.O. Then the President of the Conference, Dr Homi Bhabha, of India, delivered an address which set the keynote for the Conference. He traced the development of man from the aspect of his use of energy since the emergence of the earliest civilisations. By heavy physical labour in an eight-hour day, a man can turn out about half a kilowatt hour—not much more than is necessary to maintain him at subsistence level. Today, in one highly industrialised country, 23 kWh/head is the daily energy use.

If energy is reckoned in terms of "Q" (10^{18} B.Th.U.) then in 1950 world energy use was 10Q per century and with population increasing rapidly, this must also rise. The consensus of opinion appears to be that the total economically recoverable world resources of coal, gas and oil are under 100Q. But recoverable world reserves of uranium and thorium contain energy estimated to be of the order of 1,700Q. "If this is really so, said Dr Bhabha, "then atomic energy could first provide the energy necessary to enable under-developed countries to reach the standard of living of the industrialised countries, and secondly, enable the entire world to maintain a constantly rising standard of living for very many decades, and possibly for several centuries."

There is now no doubt that nuclear energy can be used for power generation, but Dr Bhabha went further. Recalling that, it is not yet 15 years since Fermi first released nuclear energy in a nuclear pile, he predicted that a method will be found in liberating fusion energy (as in the hydrogen bomb) in a controlled manner within the next twenty years. "When that happens, the energy problems of the world will truly have been solved for ever, for the fuel will be as plentiful as the heavy hydrogen in the ocean."

The question of the world's needs for some auxiliary energy supply was taken up at length in papers presented at the second session of the Conference. The estimates all confirmed the existing general feeling: from the fuel aspect, nuclear energy had come just in time. Only the British paper need delay us here. This concluded that the total demand for commercial energy is likely to increase, for some time at least, at a rate of at least 2% per annum. Energy use is likely to be not less than 7¼ milliard tons of coal per year by A.D. 2000, compared with 2¼ milliard in 1950. Unless nuclear energy becomes more attractive than hydro energy, supplies from this latter source should increase to 1 milliard tons coal equivalent by A.D. 2000. Present evidence suggests the existence of 3,500 milliard tons of coal equivalent of solid and liquid fuels and natural gas. In the absence of new fuels, on the assumed rate of use, solid fuels, etc., would be down to 300 years' life by A.D. 2025 at then existing rates of consumption.

Russian Reactor

First of the power station reactors to be described in open session was that of the Russians, the reactor about which there had naturually been most curiosity. The reactor has an output of 5 MW, and was completed in 1954, with electricity generation by 27th June of that year. The reactor is of the uranium fuelled, graphite-moderated type, using pressurised water for cooling. Its heat output is 30 MW.

Enriched uranium is used in the core of the reactor, the fuel containing nearly 5% of U235 instead of the 0·7% present in natural uranium. Total charge of fuel is 550 kgm. The pressurised water is circulated through a heat exchanger under a pressure of 1,470 lb/sq in. Steam from the heat exchanger is taken to a conventional steam driven turbo-alternator set.

The chain reaction of nuclear fission in a thermal reactor is rather sensitive to the quantity of water in the reactor core. Due to the expansion of the water, there is less present as the reactor heats up. The reactor then slows down, which offers a certain safety factor.

Much has been said about the difficulty there is in getting the heat away from the fuel elements of a power reactor. In the Russian reactor, the heat flow at the surface of the fuel elements is about 1,740 kWh/m²/hr.

All-nation talks on peaceful uses of Atomic Energy

reported from Geneva by K. C. POUNDS B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

Assistant Editor

This makes the problem of producing stable fuel elements one of the most critical in the design of the reactor.

About 15% of the U235 in the reactor is burnt up before fuel elements are renewed. The reactor design is such that the production of plutonium from U238 in the course of reactor operation is rather low, only about one atom of plutonium being produced for every three atoms of U235 burnt.

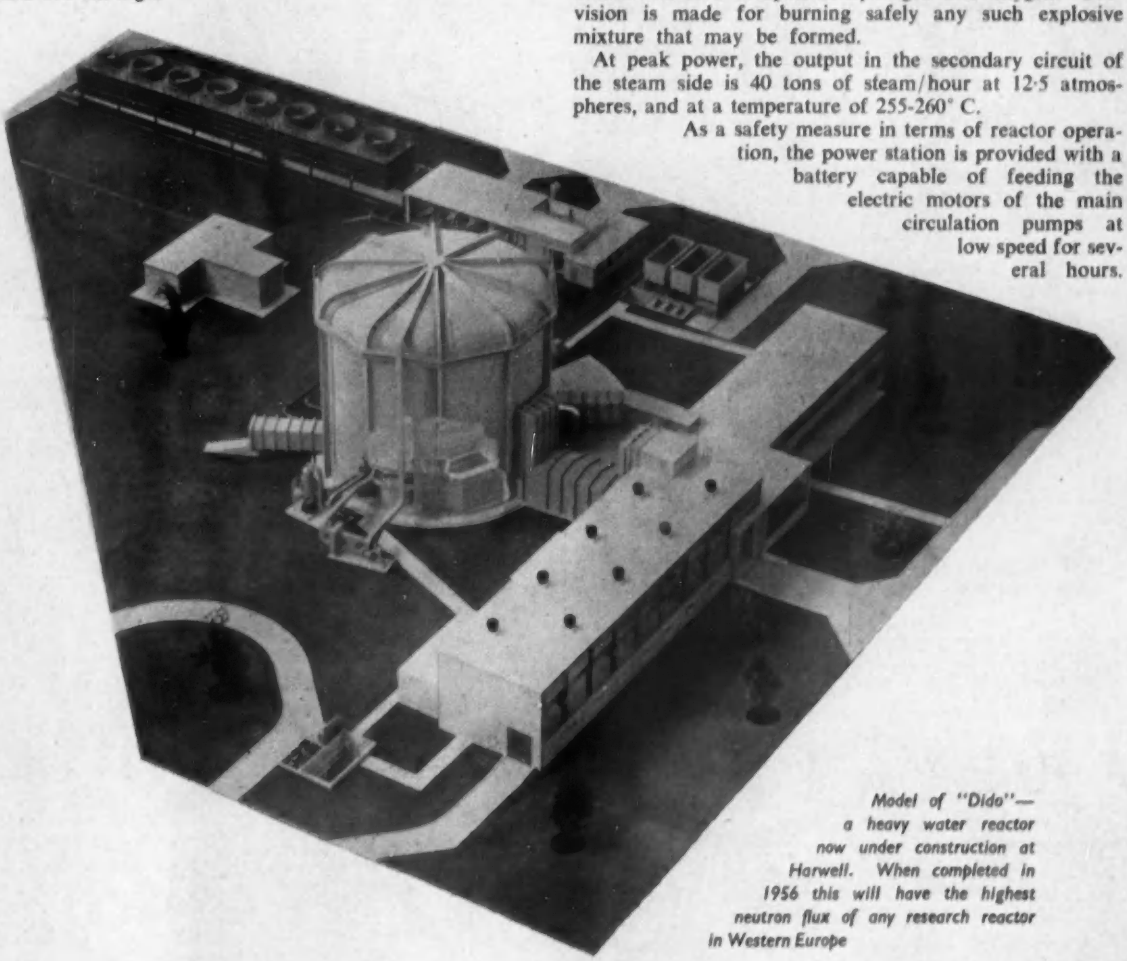
The reactor is encased in a steel pressure vessel mounted on concrete foundations. The pressure vessel is filled with a graphite block structure and to prevent this burning at the high temperature of operation, it is surrounded by an inert atmosphere (helium or nitrogen). 128 fuel channels pierce the graphite pile. Each consists of a long graphite cylinder in which is placed thin walled steel tubes to carry the cooling water. In the centre of the fuel channels are the uranium fuel elements, the water flowing over the surface. The fuel elements are arranged to form a cylindrical active zone in the reactor, 150 cm in diameter and 170 cm high.

It was found that the reactor became critical with only 60 uranium rods in position. The remainder gives surplus reactivity to allow scope for variables in operation, and they are compensated for by 18 control rods of neutron-absorbing boron carbide. Adjustment of these rods gives control over the exit temperature of the primary water.

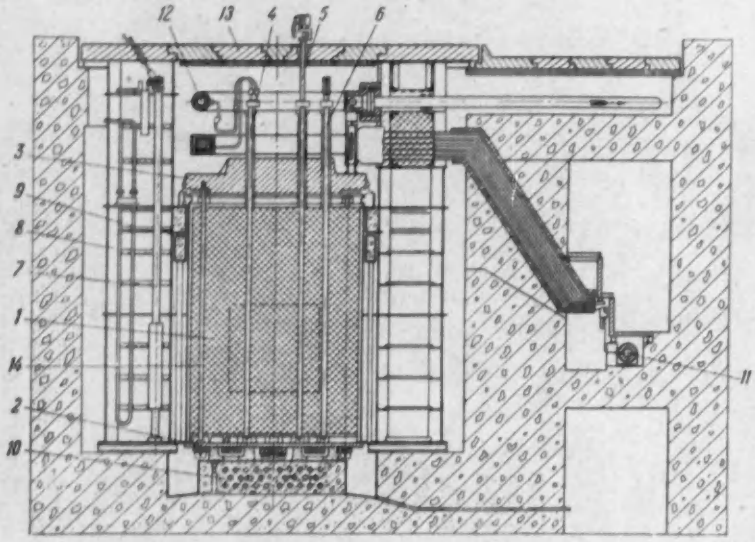
Water enters the reactor at about 190° C, and is heated to a temperature of 260° to 270° C. There are eight steam-generating heat exchangers coupled in pairs,, and at peak power operation, three pairs are in operation and the fourth pair in reserve. Each exchanger consists of three sections, a feed water heater, a water evaporator and a steam superheater. The water circulating in the primary circuit is, of course, radioactive, so special precautions have to be taken with the feed pumps. They are fed with water at the gland seals to ensure that the pressure there is always about 7 lb/sq in. above that in the pump. Another effect due to the water being exposed to a strong neutron flux in the heart of the reactor is breakdown into component hydrogen and oxygen. Provision is made for burning safely any such explosive mixture that may be formed.

At peak power, the output in the secondary circuit of the steam side is 40 tons of steam/hour at 12·5 atmospheres, and at a temperature of 255-260° C.

As a safety measure in terms of reactor operation, the power station is provided with a battery capable of feeding the electric motors of the main circulation pumps at low speed for several hours.



Model of "Dido"— a heavy water reactor now under construction at Harwell. When completed in 1956 this will have the highest neutron flux of any research reactor in Western Europe



Explanatory Diagram of the Russian Nuclear reactor

1. *Graphite masonry of the reactor*
2. *Lower plate*
3. *Upper plate*
4. *Fuel channel*
5. *Safety rod channel*
6. *Automatic control*
7. *Ionisation chamber channel*
8. *Lateral shielding (water)*
9, 10. *Refrigerator*
11. *Inlet header*
12. *Outlet header*
13. *Upper shielding (pig iron)*
14. *Reflector*

Since the station began to operate in June 1954, it has generated some 15m kWh of electricity. There has been no single case of a fuel element failing. This speaks well of the resistance to corrosion of the stainless steel used for the fuel element tubes. The graphite of the reactor became hotter than had been expected, reaching 650°-670° C at the hottest spots.

Start-up from zero to rated power takes about 30 minutes. At present this operation has to be carried out under close control by the engineers, but work is in hand on automatic control gear for this process.

Fuel elements are replaced once every two months, the operation taking two to three days. To economise on nuclear fuel, the reloading is carried out in sections, the less burnt periphery elements being moved to the middle of the reactor to replace those removed, and new elements being placed at the periphery.

Station starting from cold is possible in one and a half to two hours. Steam is delivered initially to a special starting condenser, and taken to the turbine only when designed conditions have been obtained.

Models of the reactor and many detailed diagrams are included in the Russian scientific exhibition. It was a remarkable experience and one indicative of the spirit of the Conference to stand in a group and listen to Russian engineers cheerfully submitting to informed cross questioning on details of operation and construction from American engineers.

Immediately after the Russian paper had been discussed, Dr W. H. Zinn, of the U.S. Argonne National Laboratory, described experience with the boiling water reactor which

A group of visitors at the Russian Scientific Exhibition

has been operating there. The boiling water reactor, as its name implies, produces steam for the turbine directly in the coolant passages in the reactor core. Its advantage is that it operates at a much lower pressure than other types of water-cooled reactor, for in the latter, pressure must be kept high to prevent the formation of steam bubbles, while permitting generation of a high water temperature. In the opinion of the Argonne Laboratory, this type of reactor, because of its relatively low construction costs resulting from relatively easy pressure vessel arrangements, offers the best chance in the near future of getting down to the price of conventionally generated electricity in America.

The general form of the reactor is shown on page 240. The fuel elements seen at the bottom of the illustration

TABLE 1.—AMERICAN OFFICIAL 5 YEAR REACTOR PROGRAMME

Type	Power MW		Cost dollars x 10^6	Estimated date of completion
	Heat	Electricity		
Pressurised Water	264	60	85	1957
Boiling Water ...	20	5	17	1956
Sodium Graphite	20	—	10	1956
Homogeneous Test	5	1	3	1956
Homogeneous Thorium Breeder	65	16	44	1959

TABLE 2.—AMERICAN INDUSTRIAL REACTORS

Type	Power MW	Cost dollars x 10^6	Estimated completion
Pressurised Water ...	100	24	1957
Boiling Water	180	45	1960
Sodium Graphite ...	75	24	1959
Fast Breeder	100	45	1958
Pressurised Water ...	236	55	1959

consist of a series of plates of aluminium-uranium alloy jacketted on two sides with aluminium. There are 24 such plates in each of the box-like sub-assemblies seen in the illustration. The water flows through the channels between the plates, which are spot welded into support plates. Each coolant channel is 0·264 in. by 1·27 in. in cross section, and 26·8 in. long. Because this particular reactor is used for experimental work, the whole of the core is arranged for easy removal, and to this end is carried on support rods by means of which it can be removed from the pressure vessel.

There are 88 fuel elements in all, and four ¼ in. thick by 1 ft wide boron control plates which slide up and down. A fifth control rod is in the form of a large cross of cadmium.

Feed water is fed in at the side of the reactor core, flows down the outside, and then upwards through the coolant channels. The steam bubbles formed are released in the steam dome at the top of the reactor, and steam effectively free from entrained moisture is taken off at the steam exit line.

An advantage of the boiling reactor already mentioned is the relatively low pressure possible. The design described here gives steam at 300 lb/sq in. at the appropriate saturated steam temperature. A relatively simple reactor pressure vessel can be used. The design involves a stainless steel tank, 15 ft 11½ in. high and 52½ in. internal diameter, constructed of stainless steel, ¼ in. thick.

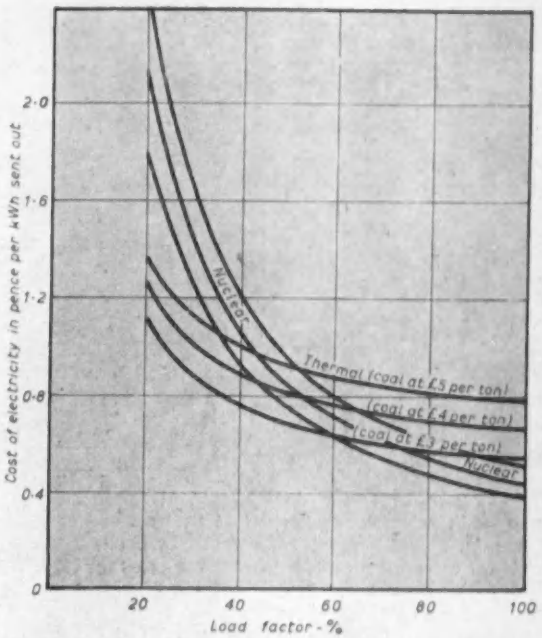
Sir Edwin Plowden (Chairman of the U.K. Atomic Energy Authority) and Sir John Cockcroft chat with Mr E. U. Lawrence of University of California

Also on page 240 is the flow diagram for the complete boiling reactor plant. Steam from the reactor dome is taken to a steam separator which improves the dryness, and then to the throttle valve of the turbine. Should electric load be lost, in which case it would be undesirable suddenly to alter the steam flow from the reactor, there is a by-pass valve directly to the condenser. This is interlocked with the turbine trip valve. Another by-pass valve is fitted to keep the pressure at the turbine steady if there are slight variations due to changes in reactor output, etc.

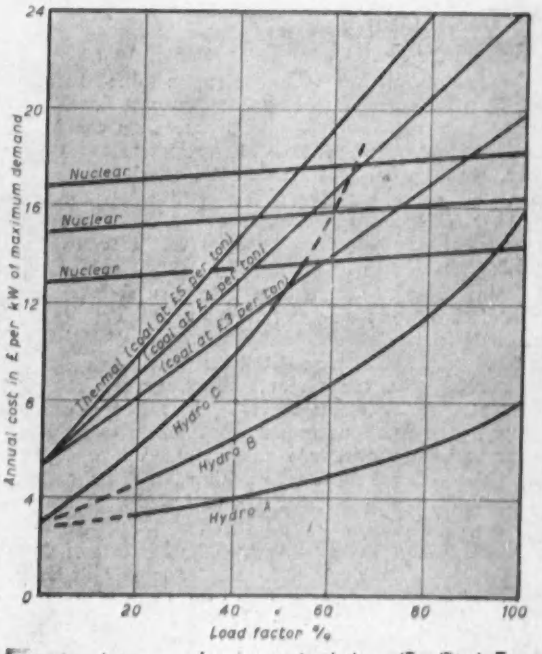
From the condenser, the water is returned to the reactor via a heat exchanger, in which the feed water extracts heat from the small quantity of water being continuously bled off from the reactor core for cleaning in the ion exchange column.

It has to be remembered that the steam in the turbine is radioactive. However, in the main, the radioactivity induced in the turbine parts is not long-lived, and maintenance is not impossibly complicated.

Apart from its advantages in avoiding high pressures, the boiling reactor offers certain safety advantages. If it is allowed to get out of hand, so that more and more



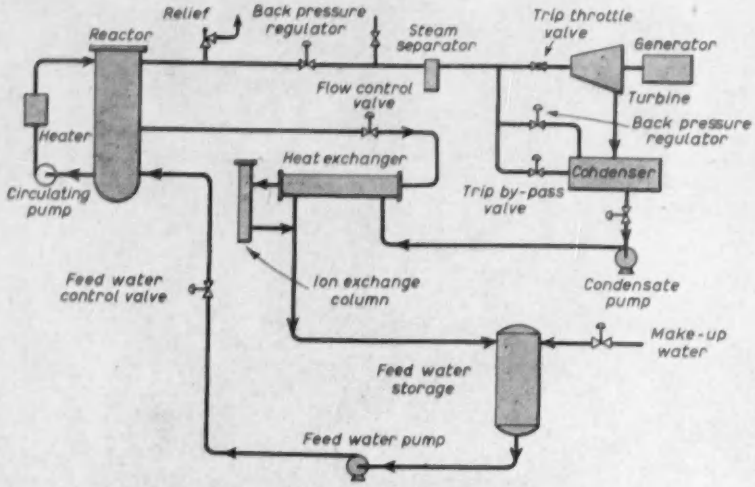
Comparison between nuclear and conventional thermal power



Comparison between nuclear, conventional thermal and hydro power

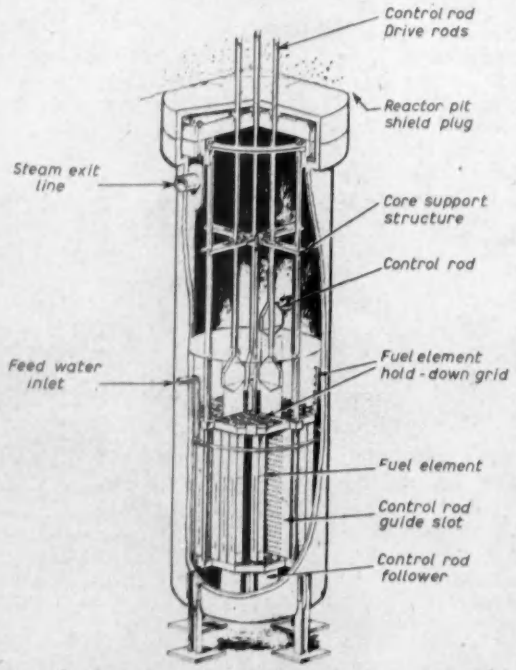
steam is formed in the core, then water is necessarily driven out of the core. Now, the water is acting as the moderator of the reactor, affecting the neutrons so that they are brought to a condition in which they can cause fission. If the water is removed there is less fission, and hence less steam generation. Thus the reactor is to a considerable extent self-regulating. Various experiments have been carried out to demonstrate this.

Prof. Zinn made no secret of his belief that the boiling reactor was the power plant of the future. However, in the discussion one of the British engineers expressed some doubt as to the practicability of extending the design to



Left: Flow diagram of the American boiling reactor plant installed at the Argonne Laboratories

Below: General arrangement of control mechanism and core of boiling water reactor



large sizes; it has to be noted that the reactor operating in the U.S.A. at present generates only about 2·3 MW. Costs for the present reactor, based on a price for U235 of 15 dollars per gram, is 3 cents per kWh. At 30 dollars per gram, it is 3·46 cents per kWh.

In reply to a question from a Russian delegate, the author said he believed there were practical boiling water designs up to 1,000 MW. It might be advantageous to draw off some hot water from the reactor and flash it into steam for feeding into a later stage of the turbine.

On Tuesday afternoon the conference turned its attention to the cost aspects of nuclear power stations. Two papers were read on this subject, one from the U.S.A. and one from Great Britain. In presenting the first of these, Mr J. A. Lane, of the Oak Ridge National Laboratory, outlined a summary of the reactor programme in the U.S. This gives a promise of some 800 MW of nuclear powered electricity generation by 1960. (See Tables 1 and 2, page 238.)

Summarising U.S. estimates, Mr Lane suggests that on a basis of 40 dollars for natural uranium per kilogram, and a credit of from 15 to 30 dollars per gram of fissionable material produced in the reactor, the possibility of achieving nuclear power costs in the neighbourhood of 0·4 to 0·5 cents per kWh seems good. It can be done in a pressurised reactor using natural uranium with heavy water as both coolant and moderator. Power costs of 0·5 cents/kWh might also be achieved with an ordinary water-cooled and moderated reactor fueled with uranium enriched by a 1% content of U235.

Breeder reactors give the possibility of costs of 0·4 to 0·5 cents/kWh with fuel processing costs of 1 dollar per gram or less. So far as can be seen, there is at present no possibility that the sodium-cooled graphite-moderated reactor can do better than 0·6 to 0·7 cents/kWh. (Note that at present rates of exchange, 0·5 cents equals 0·34 pence.)

Plutonium and Economics

In presenting the British paper, Mr J. A. Jukes dealt with a more narrow question, the value of plutonium and its effect on the cost of electricity in the next two decades. In the course of operation of a thermal reactor such as is being built at Calder Hall and elsewhere as part of the British programme, plutonium is formed to some extent in the uranium fuel rods. It has some potential value for use in future reactors, and the value arbitrarily assigned to it (in the absence of an open market) must have a major effect on the real cost of energy as produced from these early reactors.

In his discussion of the value that should be placed on plutonium for this purpose, Mr Jukes assumed an output of 150 MW from these reactors when they are built primarily for electricity generation, and a capital cost of £18·8m including all electrical equipment. The basic cost of uranium he took at £20,000/ton, allowing for the cost of fabrication, and of very slight enrichment. Then taking 4% interest rate, a 15-year life, and a load factor of 80%, the capital cost component of electricity comes out at 0·36d./kWh. Gross cost of electricity on a basis of 3,000 MW-day/ton of uranium comes out at 0·76d./kWh. It is from this figure that the value of the plutonium produced must be extracted.

The least valuable use that could be made of this plutonium would be to put it back into the reactor to burn instead of U235. On this basis costs would reduce to about 0·6d./kWh.

In fact, however, there should, for the next ten years at least, be an unsatisfied market for plutonium for peaceful

purposes for starting up more advanced types of reactor, and in the subsequent decade of 1965-1975, this demand will increase. A price of from £10/£12 per gram of plutonium is likely to be obtainable over this period, and the cost of energy from the Calder Hall type reactors should be below the present coal based level of 0·6d./kWh.

In presenting this opinion, Mr Jukes emphasised that many thought that it was possible to get 200 MW from the Calder Hall type reactors.

Thorium Reactors

Discussion of nuclear reactors usually assumes that U235 will be the fissile fuel involved, but this is only one of three possibilities. The other two both involve artificial elements that do not occur in any appreciable quantity in nature, unlike U235. The first of these elements is plutonium, which is made by exposing U238, the more plentiful isotope of uranium to a neutron flux. It is, as already mentioned, formed automatically in the uranium fuel rods of thermal reactors. Less has been heard up to now of the other possible fissile fuel, U233. This can be obtained by exposing thorium to neutrons. Now, thorium is a relatively plentiful element, and if it can indeed be used successfully as a source of fissile fuel, then the heavy fuel demands likely as the reactor programme advances can be more readily faced.

The possibility was discussed, and a favourable answer given in a paper presented by Mr J. V. Dunworth, of Harwell. He suggests that a way of getting the U233 may be to build natural or slightly enriched heterogeneous uranium reactors and after extracting about 3,000 MW-days of heat from each ton of the fuel, rearrange the fuel in the reactor so that part of the new charge consists of plutonium extracted from the spent fuel, and thorium. In this way, all the fertile fuel in the reactor apart from the first one or two charges would be thorium, though a continuing small infeed of plutonium might be needed.

The reason why the use of thorium in heterogenous reactors (those with the moderator and the fuel kept separate) is likely to advance only slowly, is the high quantity of fissile material required to get such stations started on a thorium cycle. If all new British generating stations were to be of the thorium type, then six tons of fissile material would be required every year.

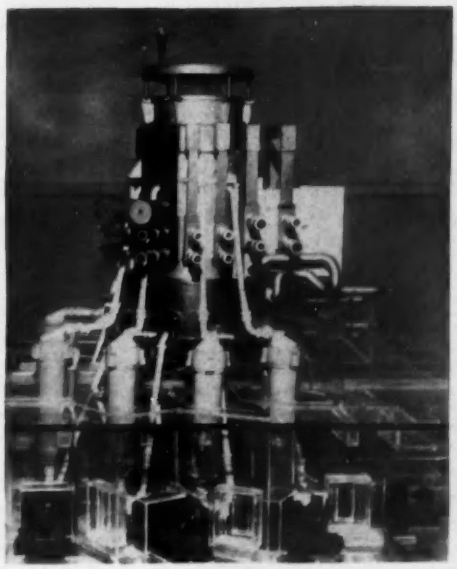
Thorium offers the attraction that even in a heterogeneous reactor, the system would be self-maintaining, i.e., an atom of U233 could be recovered from thorium for every atom of U233 consumed.

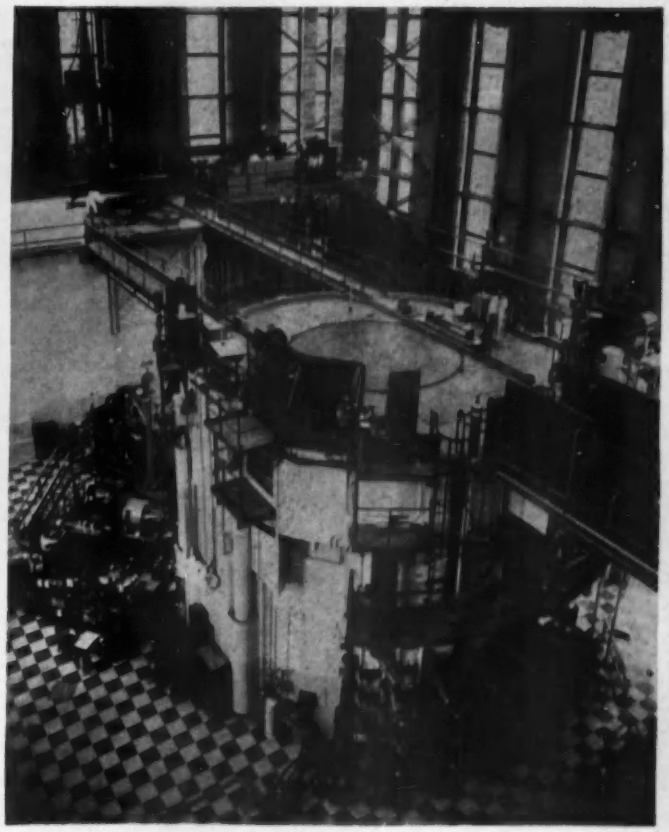
At the best, the whole electricity requirements of Great Britain could be supplied with the purchase of only 15 tons of thorium per year. This excludes that required for new construction, which might amount to another 1,000 tons of thorium per year.

It does, indeed, seem possible to achieve a positive gain factor with a "thorium-U233" homogeneous system, going up to as much as 10%. Mr Dunworth discounts the importance of this because of the time taken to reach this point. What he does consider of particular importance and promise is the fact that operation with a small negative gain factor enables a nuclear power programme to be planned with far smaller requirements for uranium than would otherwise be necessary.

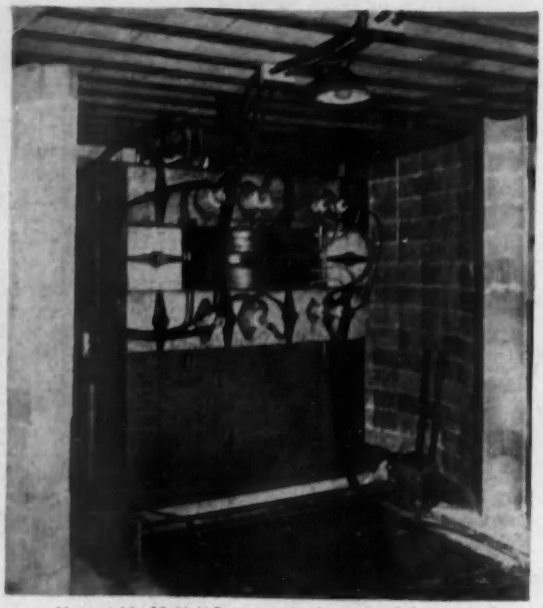
Safety Considerations

Some reassuring answers to the question, "Should nuclear power stations be reasonably safe?" were given at Wednesday's meeting of the conference. The British authors who discussed the problem were Messrs W. G.





Above: Model of Chalk River's 200,000 kW NRU reactor to be constructed. On right is the existing NRX reactor of 40,000 kW capacity also at Chalk River



Metrovick's 20 MeV Betratron in the research laboratory

Marley and T. M. Fry, of Harwell, and the approach they adopted was to estimate the area which might be affected by a serious accident at a nuclear power station, and compare this with the danger that might follow a disaster in a factory handling chlorine or phosgene on a large scale.

If a reactor of 100 MW rating were to release all its accumulated fission products, anyone breathing the cloud that would result within a distance of 2 km (1¼ miles) from the reactor site would be killed, while at the other limit, there would be no injury 17 km away (10½ miles). For comparison, it is estimated that a man standing 2 km downwind of an accidental release of a 10 ton tank of phosgene would have a 50% chance of survival. In many densely populated areas there are tanks containing enough liquified gas to kill thousands of people if it escaped. Reliance is placed on sound engineering and safe custody of such materials.

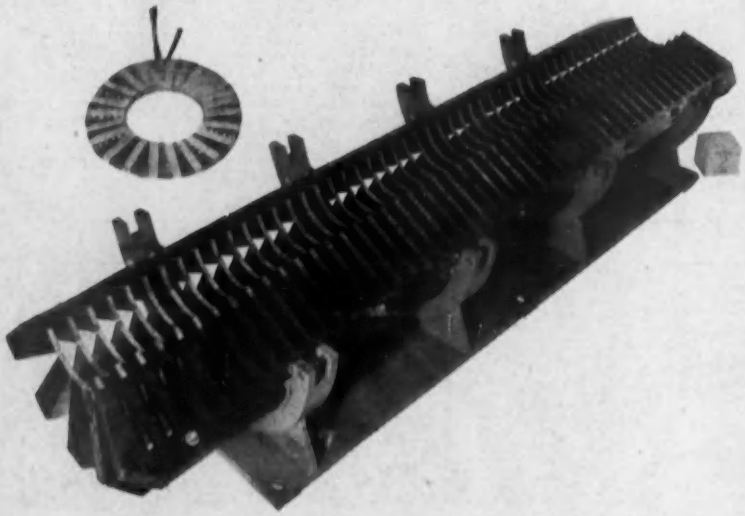
The American paper on this safety and siting topic was presented by Mr. C. R. McCullough, Chairman of the U.S. Atomic Energy Commission's Advisory Committee on Reactor Safeguards. It is a shade more cautious than the British estimate, partly because of the background approach. To quote from the paper: "The operation of nuclear reactors appears safe, and it is, in fact, deceptively safe. A nuclear reactor will not run away unless a number of serious mistakes of planning and operation should be committed. It is, however, impossible to conduct extensive operations for a long time without occasional occurrences of such mistakes. We have been exceedingly lucky so far that nobody has yet been killed by a runaway reactor."

A "Run-Away"

The Americans have carried out a number of experiments in which reactors have been allowed to run away. These are described in a paper, "Experimental Determinations of the Self Regulation and Safety of Operating Water-Moderated Reactors." The use of a water moderator of course involves the probability that the moderator will be expelled from the reactor core if heating becomes excessive. One boiling water reactor of the general type described in the paper by Zinn (see page 238) was sacrificed in an experiment violent enough to melt the fuel plates. One control rod, equivalent to 4% excess reactivity was completely ejected from the core. This rod was only 80% of the way out of the core when the reactor reached maximum power.

The power excursion (the technical term for such an uncontrolled event) melted most of the fuel plates. The pressure resulting from the molten metal in contact with the reactor water burst the reactor tank and ejected most of the contents of the shield tank into the air. The sound half a mile away is noted as being equivalent to the explosion of 2 lb of 40% dynamite on bare ground at the reactor position. Most of the heavy debris fell to the ground near the shield pit, the one ton control rod drive being thrown about 30 ft vertically into the air. Maximum travel of recognisable fuel rod fragments was 20 ft from the reactor site.

In the discussion on these papers, Mr McCullough revealed that the Americans are giving attention to a "fuse" for incorporation in a reactor. This would take the form, typically, of a "pile poison" (a strong absorber of neutrons) contained perhaps under pressure, and released into the reactor core if the temperature of the core rose dangerously. Mr Dietrich, commenting on the reactor runaway experiment in which a reactor was allowed to blow up, stated that there was little evidence of chemical energy from the oxidation of the aluminium fuel cladding adding to the violence of the explosion. He had emphasised in reading the paper that the explosion was comparatively lacking in violence even for the amount of energy released.



A British Thomson-Houston annular linear induction pump at an early stage of assemb l

Nuclear Fusion

Further comments on the progress being made towards controlled nuclear fusion was made by Admiral Strauss, of the U.S. Atomic Energy Commission at a press conference held last Thursday. He said that the Commission had been working on the subject

(*continued on page* 249)

INDUSTRIAL MAINTENANCE

Guarding Against Unusual Electrical Hazards

by H. Allen

IN spite of the comprehensive umbrella of statutory regulations which covers the use of electrical equipment, and makes a solid framework of safe working, investigations so often show that certain hazards were not anticipated or guarded against. With the broad sphere of working with electricity, now largely documented under codes of safe practice, the search for even tighter accident-prevention control has shifted to the specific, detailed, applications and usages. The spotlight must be turned on to case studies that arise and exemplify the gaps that still exist in codes of practice. Under each of the headings, shock and fire, can be listed those hazards which have been empirically revealed. To analyse each of those, and then to construct a safety policy is the essential technique.

Static

In the matter of fire, for instance, it sometimes seems that enough attention is given to static electricity. Yet there is a marked rise of ignition from static electricity discharges under many circumstances, such as the transfer of inflammable liquids from one container to another. When, for instance, some inflammable liquids such as petrol move along a hose from a pump to a tank, there may be a substantial accumulation of static charge at the nozzle. Unless the receiving tank and the discharging tank are bonded together electrically, there is a risk that a spark may move from the nozzle to the receiving tank and ignite the inflammable vapours which are liberated as the liquid is discharged from the nozzle.

It is true that most hoses are integrally grounded but it is imperative to check that the hose ground wire is connected to the pump and to the nozzle.

Steam passing through hoses will also generate static electricity, while leather or rubber belts running on pulleys have frequently been known to produce a charge of static electricity large enough to ignite inflammable vapours.

Fortunately the precautions for scotching the hazards of static electricity are simple. All drive belts should be made of conductive material, or fitted with static collecting brushes. The metallic, non-current carrying sections of machinery and conveyors should be bonded together so that one part is never insulated from another. Furthermore all fan belts in ventilating systems used to exhaust inflammable vapours, and all belts used in driving machinery and compressors in areas where inflammable vapours are likely to accumulate, should be conductive, so as to prevent the formation of a static charge.

Spillage of inflammable liquids is frequent and an accident reported recently showed the need to take full precautions against ignition by electricity, of vapour. The accident was in a garage inspection pit, where vapour had accumulated through petrol spillage. A portable handlamp being used, was dropped and ignition caused instantly, since the lamp was not of the intrinsically safe pattern as recommended by the Factory Inspectorate.

Another accident officially reported recently illustrates the kind of thing that can happen. Work was being carried on at an outdoor substation, on 33 kV switchgear, and the fitting of wire mesh screens to divide the structure, was involved. Some of the screens ran longitudinally down the centre and some ran across the structure to form bays. Work was confined to one bay at a time and supply had to be maintained.

The top longitudinal central screen was to be fitted and access was from one side of the structure which had been made dead including the busbars. The other side of the bay had also been made dead except for the outer fixed contacts of the open air-break isolating switch. These contacts were on the extreme outside of the far side of this bay and were connected to the live busbars below. Ten feet separated the contacts and the centre line and everything between the live contacts and the centre line was dead. A linesman wanted some dimensions and elected to reach his destination by means of a narrow channel section, cross member which was 4 ft from the centre line and about 6 ft from the outer live connection. Half way over he fell, and in falling he touched one of the live conductors. He was a skilled man, familiar with the work. But he attempted to take an unsafe means of access. The case underlines two cardinal points; the need to provide means of safe access and the need to train all operators in their use.

Protecting employees against their own mistakes (or carelessness) is inherent in all accident prevention work and is nowhere more important than in work with electricity. And if there is one sphere more than another where this protection is required, it is with testing. Statistics annually show the high incidence of accidents occurring during testing operations of one kind or another. Electrical test department men often have to work with high voltages. The need to detail a comprehensive safe working policy covering testing is therefore of paramount importance. It is now established practice to block off by cages all working areas in which transformers are tested. The system of two men working together (what in America is called "the buddy plan") is also standard. This should mean that when a tester sets up a heat run in a caged working area, his partner should be at a nearby control switch. Further if the cage gate is opened, all current should automatically shut off, not running again until a line starter is manually re-set.

Earth Connections

Testing earth connections can throw up some hazards unless the work method is blanketed for safety. One of the most common tests when a fairly high current at low voltage is passed through from the casing of the equipment to the earth pin on the plug, presents a case in point. The question arises, what value of current is to be recommended and for what length of time should it be passed.

A duration of from two to three seconds, with a current of 12 to 20 amps is probably safest although the current is governed by the amount of current which the cable rating, and that amount will vary according to the type of cable. It is usual to employ a high reactance transformer to avoid overload.

All testing equipment must be kept in 100% condition, a fact which hardly needs stressing but it is not perhaps sufficiently appreciated that earth leakage indicating and recording instruments, for instance, show gradual deterioration and that it is therefore essential to keep the devices capable of maximal performance if they are to be prevented from producing misleading results. Faulty connections have often been the cause of such results.

The emphasis is, as always with electrical hazards, on detail. Current, official codes of practice, based on expert recommendation or on legislation will point the broad way to safe working. But, in day-to-day operation, the real heart of accident-free operation will lie in that definition of safety habits that cover the detail, the unexpected but comprehensive hazards, that electricity can manifest.

FACTORY FIRE ALARMS

Recommendations for their Installation and Maintenance

FIRE alarms are disappearing from the streets, being supplanted by the increasing number of automatic public telephones, but they still have a part to play in securing a high standard of safety in the factory. Some means of giving warning of fire "which shall be clearly audible throughout the building" is required under the Factories Act, 1937, in any factory where more than twenty persons are employed in the same building, or where explosive or highly inflammable materials are stored or used in a building in which persons are employed. It is a natural precaution to combine the alarm signal with some system of well-spaced call points, and the resulting system usually becomes the maintenance responsibility of the electrical section.

General notes on fire alarm installations are available in a British Standard Code of Practice,* and many of the suggestions made merit close attention by engineers having such installations in their charge.

Siting of call points should be such that no one need walk more than 100 ft from anywhere within the premises served to give the alarm. Further, such call points should be preferably placed on the way out from premises, in particular on stairway landings and at street exits. A fixing height of 4 ft 6 in. above the floor is recommended. For the actual alarm system there are many possibilities, bells, hooters and sirens coming at once to mind. The essential requirements are a distinctive tone and enough power to overcome background noise. Except in the smallest buildings, it is obviously wise to duplicate such alarm sounders.

Operating Systems

Fire alarm design can be divided into closed-circuit and open-circuit working, the title describing the no-alarm working conditions. Pressing the alarm button in the closed-circuit system breaks the circuit to operate the alarm. Thus, the closed-circuit system offers the advantage that since the current is flowing all the time, the system is constantly under test. Most faults are likely to have the same effect as an alarm call, that of breaking the circuit and causing alarm sounders to operate. Obviously, a double earth fault is a possible exception. In any case, it is considered desirable to provide the fire alarm system with fault indications covering abnormal conditions.

Operating voltage for a fire alarm system is preferably 100 V or below, and 250 V should be the absolute limit. It is important to bear in mind that the system may have to operate under emergency conditions, and all components should function satisfactorily even with the voltage down to 80% of normal.

Power Sources

The desirable power source for an alarm system is a secondary battery continuously trickle-charged from a.c. mains. In addition, provision should be made for recharging the battery sufficiently in an eight-hour period to supply the maximum alarm load at an adequate voltage for at least two hours. Alternative sources of supply noted in the Code of Practice and (i) two independent secondary batteries charged from d.c. mains and arranged so that one may be charged whilst the other is in service; and (ii) two independent primary batteries, one on load and the other in reserve.

In contrast to the usual safety ruling, fire alarm circuits provide an instance where the use of fuses and circuit-breakers should be kept to the minimum consistent with safety. The reason for this is clearly maximum availability of the alarm system. When the supply is taken from primary batteries, fuses, etc., may be omitted. Elsewhere, the recommendations is that all overload-protective devices be arranged to operate at about three times the maximum working current and to give audible warning of their operation.

The essential fact, already mentioned, that when the alarm system is required to operate, conditions are likely to be abnormal, limits the range of wiring systems acceptable in an alarm installation. For internal use, mineral-insulated metal-sheathed cable has obvious advantages, the recommendation being that the conductor should not be smaller than 1/·044 in. Cables in conduit (3/·029 in. minimum) or hard-metal-sheathed designs provide alternatives.

Whatever system is used the wiring should be exclusive to the fire-alarm installation, and individual alarm circuits should be kept as widely separate as possible, so that one fire will not be likely to put all out of operation.

Maintenance

One point stands out about maintenance arrangements in connection with a fire-alarm system. Responsibility should be laid firmly on the shoulders of one man, preferably of executive level. Apart from this, maintenance procedure must obviously be closely based on the recommendations of the manufacturers. Specific suggestions made in the Code of Practice are as follows:

Batteries. Secondary batteries and charging equipment should be inspected at weekly intervals, and checked for trickle-charge operation, and level and specific gravity of electrolyte. Primary batteries should be checked by observing the voltage when a resistance is placed across their terminals to give a current flow for a few seconds of twice the maximum alarm load current.

System and alarm test. A test simulating an actual alarm should be made from at least one call point each week.

Insulation and earth-continuity tests. A quarterly test should be made of these circuits.

**British Standard Code of Practice CP 327. 404/402. 501, "Electrical Fire Alarms."*

Keep Your Motors Running

A BOOKLET under the title "Installation and Maintenance of Electric Motors" has been published by Brook Motors for many years now. So many years, in fact, that the original charge of 1s. per copy has been far exceeded by production costs. Since requests for the booklet continue to be made, the company has now published at the original price an abridged version of 128, 4¼ in. x 3 in., pages, called "Keep Your Motors Running." Copies of this may be obtained from the Publications Department, Brook Motors Ltd., Empress Works, Huddersfield.

One of the most useful sections of the book is a 48-page compendium of motor horse powers appropriate to a very wide range of duties. As an example of the information given in this section, the section on woodworking machinery recommends ratings for the following machines in various sizes: circular saws, bandsaws, rack circular saw bench, suspended cross-cutting machine, planing machines, spindle moulders, mortising machines, tenoning and scribing machines, sandpapering machines, lathes and universals. In addition there are notes on the preferred motor enclosures and on available special motors.

Installation of motors and associated drives receives attention in the next section, with some suggestions as well for fault finding, and power factor correction is discussed, a useful chart being provided.

In the final section of the book, there is a collection of motor and control gear connection diagrams for three-phase, single-phase and f.h.p. motors, and then a few tables giving some of the constants (cable and fuse ratings, etc.) commonly needed when installing motors.

Electrical Apparatus Co.
Type MF2L Auto Switch

DATA SHEET 19

THE MF2L Auto switch, made by the Electrical Apparatus Co., Ltd., is a stock item designed for the direct switching of motors up to 7·5 h.p. on 340/550 V and 3 h.p. on 200/250 V supplies. It complies fully with B.S. 587. Size: 10¼ in. x 6 in. x 5½ in. Weight: 7¼ lb. If without isolator, size becomes MF2.

Construction

This starter is contained in a die-cast aluminium alloy case, the lid of which, carrying the press button stations, fits snugly on to a lip, making the starter virtually dustproof. The four screws holding the lid are captive and the push buttons are provided with a standard fitment consisting of a plate engraved on one side "Start," "Stop and Reset." The plate may be reversed so reading "Test"—"Reset" and can be slid over either push button when depressed and then locked. The addition of a try-out switch thus becomes unnecessary where a 2-wire control is employed.

The case is drilled for ¾ conduit on each side and on top and bottom. Blanking pieces are provided but fittings for armoured or c.t.s. cable can be supplied if necessary.

In the top of the case is the 4-pole isolator, cam operated by the handle on the right and interlocked with the lid. The mechanism can, however, be operated with the lid removed by depressing the automatic catch. The isolator is of the quick make, slow break variety with flat to flat silvered contacts.

Below the isolator is mounted the overload and single-phasing preventor, actuated by indirectly heated bi-metal elements and tripping the contactor coil by breaking the control circuit. The stop and start contacts, of ingenious design, are also mounted on this unit. The overload is mounted on pads at the back of the case by 2 screws.

The bottom of the case contains the contactor which is self-contained, held down by 2 screws and resting on 2 short pillars. Most of the screws used are captive.

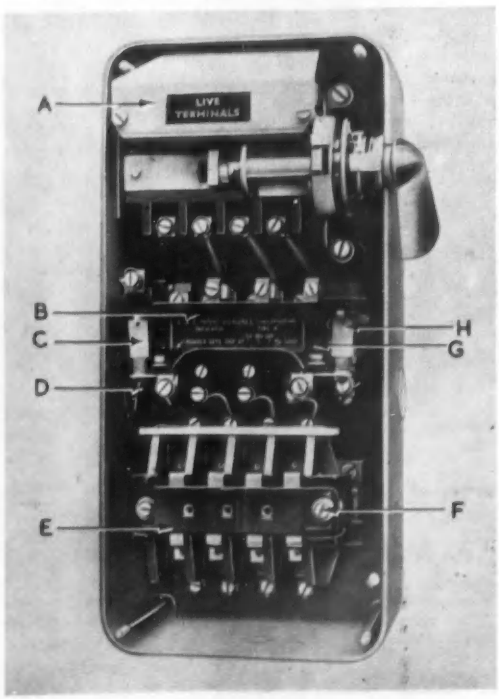


Fig. 1. General view of auto switch. (A) Isolator, (B) Overload and single-phasing preventor, (C) Start switch, (D) Overload setting, (E) Contactor, (F) Screws retaining moving contacts, (G) Trip bar, (H) Stop and reset switch

The Isolator

The main body is a moulding on which is mounted the cam mechanism and this cam, operated by the side lever, lifts a moulded carrier bearing the 4 isolator contacts, to close the circuit.

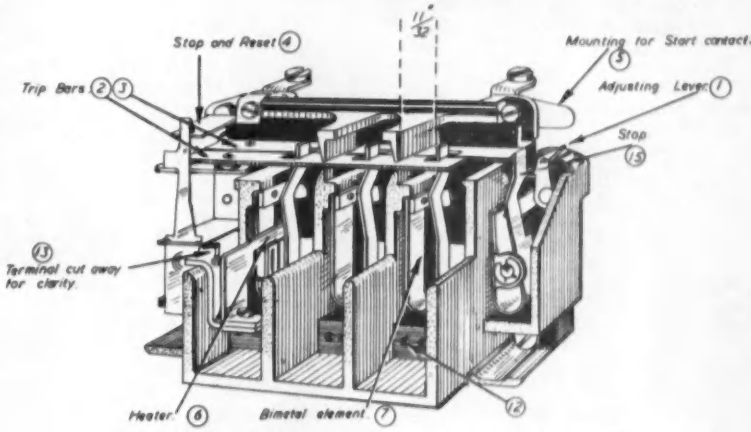


Fig. 2. Details of overload unit and single-phasing preventor

Overload and Single-Phasing Preventor

This unit is shown in detail in Figs. 2 and 3. It is of moulded construction consisting of 2 main parts joined on the dotted line 17 (Fig. 3). These 2 sections form 3 cells, one for each phase, and cavities are provided for the terminals, stop and start switches and for the fixing lugs.

In each cell is fixed a U-shaped bi-metal element, the tip of which projects through slots in the 2 trip bars 2 and 3, (Fig. 2). These elements do not carry current but surround the heater (6), one in each line, anchored at one end by an ingenious clamplink device and at the other by the terminal 13 (Fig. 2).

(Fig. 2 is a view looking diagonally on top of the unit, with the cover (11) removed.)

The two trip bars, of fabric base bakelite sheet, engaging the tips of the 3 bi-metal elements, slide in a cavity formed by the 2 moulded sections. At one end, the left, Fig. 3, the motion of the trip bars by reason of any movement of any or all the bi-metal elements during a period of overload, is limited by the stop or temperature compensated strip (15).

The other ends of the trip bars (2) and (3) are linked to a small lever (16) which in its turn engages the top contact (4), Fig. 2, during overload conditions.

In order to show the action of the 2 trip bars they are drawn separately in the lower part of Fig. 3.

During normal overload conditions, as for example while the motor is starting and with equal current in each phase, the tips of the 3 bi-metal elements, being similarly heated, will all tend to travel to the left, i.e. towards the compensated strip (15) and convey both trip bars in the same direction.

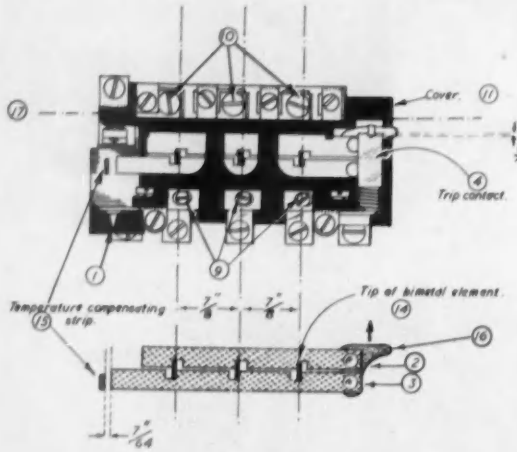


Fig. 3. View from top of Fig. 2 (overload unit and single phasing preventor) with details of trip bars below

When the 2 trip bars have moved to the compensated strip (15), preset to correspond with the tripping value required, the motion of the longer strip (3), will be arrested. This will cause the shorter bar (2) to move differentially and in so doing will pull the lever (16) and trip the stop switch (4) so opening the contactor.

Should, however, the current be greater in one line, so causing a large movement of one particular bi-metal element, the short bar (2) will almost immediately begin to move in relation to the other bar (3), because the latter will be held by the single bi-metal element. Here again is a differential movement which will pull the lever (16) and open the control circuit.

Such is the action of the thermal overload and single phase preventor. It should be noted that the preventor feature operates independently of the overload setting.

The stop (15) being the end of the temperature compensated strip will allow for variations in the ambient temperature.

Adjustment of this stop is via a cam and lever (1) which can be set in 3 positions to give 100%, 125% or 150% of the load current for which the heater is rated.

The Contactor

This is mainly of conventional design. It is not gravity controlled, the contact arm being returned by 2 compression springs. The main body is a moulding to which is fixed the 2 supporting brackets and lower magnet assembly, spring mounted. There are 4 pairs of copper contacts with non-weld tips.

Maintenance

The Isolator. There should be little need to attend to this item. If the contacts require renewal the insulator must be removed from the case by undoing the 2 pillar screws and removing a self-tapping screw on the left hand side of the housing. Removal of 2 asbestos strips on the back of the isolator allows the contacts, both fixed and moving, to be reached.

The actuating lever and the spring loaded dogplate are not captive and will be loose items when the isolator is withdrawn.

The Overload and Single Phasing Preventor. This unit should not be tampered with unnecessarily.

To Change Heaters. Slack off screws 9 and 10 (Fig. 3) and withdraw heaters 6 (Fig. 2). To refit, reverse process, ensuring that the screws 9 are slack enough to allow the end of the heater strip to be dropped into the wedge clamp without force.

If it is ever necessary to dismantle the whole unit the cover 11 (Fig. 3) must be removed. First slack off screws in holes 12 (Fig. 2) to allow terminals 13 to be raised sufficiently to leave cover free for withdrawal.

After reassembly the following points must be checked:

1. The trip switch contacts 4 (Fig. 3) should engage by 3/64 in. The horizontal contact should touch the circumference of the small hole in the vertical contact but not cover it.

2. With the left hand side of each bi-metal element just touching the left hand side of its notch in the trip bar 2 there should be a space of 11/32 in. between the bi-metal element and the moulded barrier (Fig. 2). The tips of the bi-metal elements should be $\frac{7}{8}$ in. apart.

3. The right side of each notch in the trip bar 3 should just touch the right side of the corresponding bi-metal element and with the adjusting pointer 1 (Fig. 2) on the centre mark there should be a gap of 7/64 in. between the end of bar 3 and the compensating strip when the latter is held against its cam.

Each heater has a code reference stamped on it and sets of heaters are supplied complete with rating plate inserts for adding to the external nameplate.

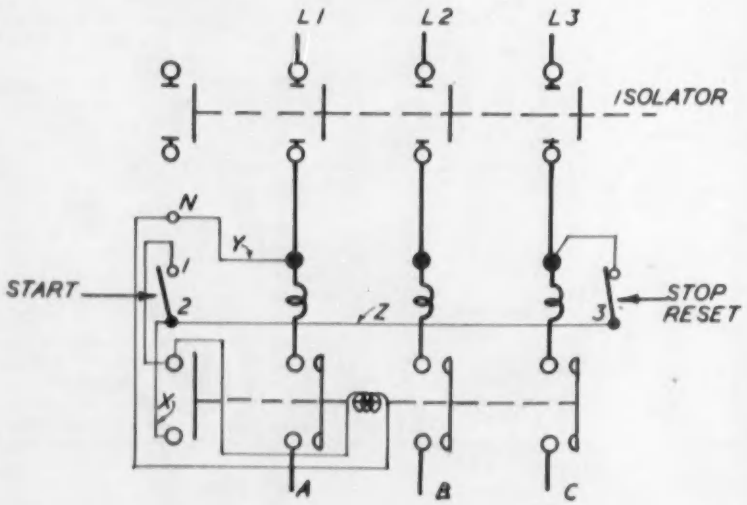
The Contactor. To renew contacts undo screws F (Fig. 1). This will release top magnet assembly and floating contact carrier. Each screw has 2 spring washers, a plain washer and a compression spring. The moving contacts are inserted into cavities in the moulded carrier and retained by small compression springs. The fixed contacts can now be reached, each being held by one screw in a metal insert.

If the main moulded body is now lifted the solenoid coil is also exposed and can be easily changed.

General

Do not fill or dress the contacts. New contacts should be bedded in by repeated operation of the starter without load.

Keep the starter clean and keep cable runs clear of the mechanisms.



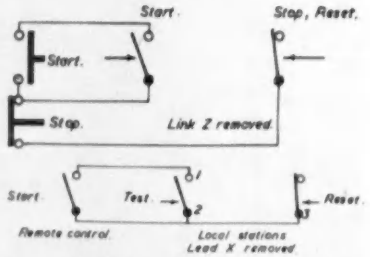


Fig. 4 (left) shows diagram for three-phase supply. If coil is required to be connected to neutral, remove connection Y and bring neutral to terminal N. When isolator is fitted, the lead Y may be taken to the spare isolator terminal instead of to L1 and the neutral taken to this instead of N. Fig. 5 (top, above) shows connections for local and remote push buttons, and Fig. 6 (above, bottom) connections for a single-way switch

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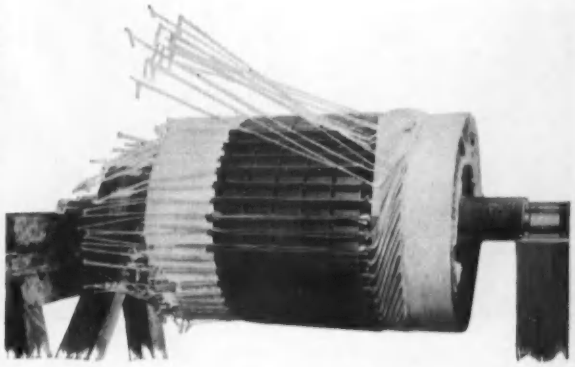

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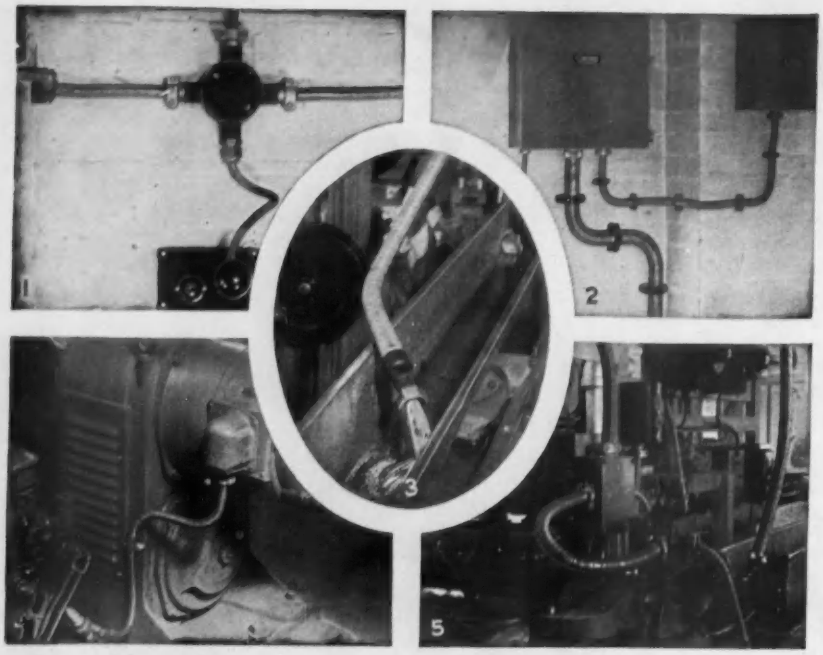

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Planned Maintenance by Order

STATUTORY SCHEMES FOR COAL MINES INSTALLATIONS

SUCCESSFUL maintenance is an essential to the efficient operation of a factory but in industry generally, there is only an indirect legal demand for it. A very different situation now applies in coal mining, under regulations[1] which became effective just under a year ago (1 Sept., 1954). Comparison of the position provides food for thought, though it must always be remembered that the special dangers attaching to work underground make legislation more appropriate there.

For industry generally, where the Factories Act applies, there are relatively few mentions of "maintenance" in the relevant rules and regulations. As Mr Swann[2] pointed out in an article in "Industrial Maintenance" in the Electricity Regulations[3], the only effective mention is in Regulation 1, where there is a general requirement that all apparatus and conductors shall be, amongst other things, "so . . . maintained . . . as to prevent danger so far is reasonably practicable." Thus some maintenance is essential, but to what end is not clearly stated.

In an official memorandum[4] on the Regulations, the Senior Electrical Inspector of Factories has stated his opinion that maintenance in this respect will entail not merely painting and general care, but also routine examination and where necessary, testing.

Maintenance in Mining

In the coal industry, in contrast, there is a specific requirement for a proper scheme of maintenance under the Coal Mines (Mechanics and Electricians) Regulations, 1954. One section of these Regulations lists the requirements set out in the accompanying table.

Here again, as with the Electricity Regulations under the Factories Act, a Memorandum[5] has been issued: but there is more to work on. The accent on system in examination and testing runs throughout the official comments, pointing to preventative rather than breakdown maintenance.

As an example of the points requiring special attention in statutory maintenance schemes, the Memorandum lists the following:

(*a*) External examination of electrical plant and of any means of support, suspension, housing or protection,

(*b*) Tests of insulation resistance of the plant, including cables;

(*c*) In the case of plant other than cables, an examination of the working parts, enclosure and any protective devices;

(*d*) In the case of an earthing conductor, the metallic covering or metallic screens of cables or earth electrode, tests of the conductance; and

(*e*) In the case of plant repaired at the surface, a voltage test of the insulation at not less than normal working voltage.

Having evolved a maintenance scheme, consideration has to be given to the men who operate it. Leaving aside for the moment the question of qualifications of electrical engineers and electricians, the Regulations make provision for linesmen, armature winders, blacksmiths, welders, etc., to carry out electrical and mechanical duties of limited scope. Such men can do whatever job is assigned to them provided—and it is a most important proviso—that their duties are defined precisely by the manager in writing.

In the interests of safety, two restrictions are made to this permission for other than certified electricians and mechanics to undertake electrical and mechanical work. Again, these requirements are worthy of wider attention. The first states that the men involved shall not carry out any work on the installation repair examination or testing of either mechanical or electrical plant for which technical knowledge and experience are necessary to avoid danger, without supervision of a mechanic or an electrician. How much supervision is necessary in a particular case obviously depends on the difficulty and danger of the work concerned, and on the skill and experience of the workman involved. Second of the restrictions concerns the special precautions necessary before work is carried out on any conductor operating at 25 V or above—or near to any such conductor which is exposed.

Certification

The base on which all this maintenance programme rests is the certification of electrical and mechanical maintenance personnel. So far as electrical equipment is concerned, a "competent person" has to be appointed as electrical engineer or electrician in charge. After allowance has been made for men who have gained suitable experience before the new Regulations came into operation, there are three levels of qualification which will be recognised. Electrical engineers will be required to hold a university degree in engineering, or H.N.C. in electrical engineering, or the equivalent. Class 1 electricians need O.N.C. in mining plus O.N.C. in electrical engineering; class 2 electricians O.N.C. in mining in the appropriate group—or equivalents, in both cases. In addition, under the detailed requirements issued a few weeks ago, suitable practical training and subsequent experience is required.

REFERENCES

1. The Coal Mines (Mechanics and Electricians) General Regulations, 1954.
2. Some Points About the Electricity Regulations," by H. W. Swann. "Industrial Maintenance," p. 10, ELECTRICAL TIMES, 15 July, 1954.
3. The Electricity (Factories Act) Special Regulations, 1908 and 1944.
4. Memorandum by the Senior Electrical Inspector of Factories on the Electricity Regulations. Fourth Edition.
5. Memorandum on the Coal Mines (Mechanics and Electricians) General Regulations, 1954. H.M.S.O.

THESE REQUIREMENTS CONTROL MAINTENANCE SCHEMES AT COAL MINES

(1) The Manager shall ensure that there shall be at all times in force a scheme in respect of all mechanical plant at the mine and, if electrical energy is used at the mine, a scheme in respect of all electrical plant thereat, and any such scheme shall provide for the systematic examination and testing of all mechanical plant or electrical plant (as the case may be) at the mine to ensure proper maintenance thereof.

(2) Any such scheme shall specify the intervals (which may be different for different plant and parts of plant) within which all mechanical or electrical plant (as the case may be) must be examined and tested and the nature of the examination and testing to be carried out on each occasion.

(3) The schemes for a mine or copies thereof shall be kept at the office at the mine and shall be produced to, or copies thereof shall be sent to, the inspector of the division at any time at his request.

(4) If the inspector of the division is of the opinion that amendment of a scheme is necessary to ensure the proper maintenance of the mechanical or electrical plant at the mine, he may by notice served on the manager require him to remedy the defect and the manager shall amend the scheme accordingly unless it is determined in the manner provided under the Act for settling disputes that the scheme is not defective.

EQUIPMENT FOR ELECTRIC STEELMAKING

A Review of Current Design Features

ELECTRICITY is already used on a large scale in steel-making and processing, and the steel industry has been making confident predictions of further increases in electricity consumption due to the extended application of electric arc furnaces. One of the important developments in this field was the publication of results obtained by fourteen electricity supply authorities and a coal research organisation in America. This suggested that capital expenditure on an electric steel melting shop is about 60% of that on an open hearth melting shop of similar capacity in the case of a works producing 250,000-500,000 tons/year.

Attention was given to electric heating in the June 1955 issue of the *Journal of the Iron and Steel Institute*, where a number of papers bearing on the subject are introduced. They include some notes on the design and operation of associated electrical equipment which directly concerns electrical plant engineers.

Switchgear

Switchgear is usually a point of difficulty, since the control of large arc furnaces is a particularly onerous duty. Mr D. F. Campbell, one of the authors, states that for medium-sized arc furnaces, British and U.S. practice differs considerably. Here the oil circuit-breaker is usual, and gives little difficulty apart from the need of maintaining oil and contacts. In the U.S.A., however, air-break switchgear is widely utilised. Suitable designs of air-break switchgear are available with breaking capacities up to 500 MVA at 15 kV. This echoes the point made in a paper two years ago by Mr T. B. Rolls, who has had so much to do with the largest industrial installations. Of course, it is the potential fire risk associated with oil that makes air-break gear preferable to some engineers, but whether practice, in this country will change as suitable air-break gear becomes available, remains uncertain. For the largest furnaces, air-blast switchgear is considered advisable.

It needs to be remembered, Mr Campbell points out, that a switch designed for distribution service, unless particularly robust, is not usually suitable for arc-furnace control. Instead of operating for its designed duty of, perhaps, several hundred times a year, it may have to open and close the arc-furnace circuit 15,000 to 20,000 times in the same period, if off-load tap-changing gear is fitted.

Transformers

This same consideration of varying operation and consequently more severe service applies also to the furnace transformers. During the melting period the load fluctuates rapidly, with the result that the windings experience sudden mechanical stresses; and from the insulation aspect, the number and magnitude of voltage surges are greater than in normal distribution service.

Load control is usually by tap-changing, and the usual practice is to use an off-load switch for this. It is worthy of note, however, that the 15 MVA Birlec-Lectromelt furnace which was installed recently by Samuel Fox and Co., Ltd., uses on-load tap-changing, giving a range of 90 V to 325 V. Operation of this furnace has been described by Mr R. Wilcock in another paper in the *Journal of the Iron and Steel Institute*. He states that melting is started on the 208 V tapping, working up gradually to full power at 325 V. Using full input of 15 MVA, the power is about 12 MW. When the charge is fully melted, voltages from 208 V to 125 V are used, with power from 2 to 6 MW.

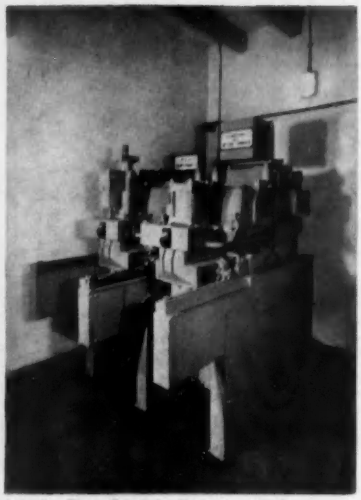


Fig. 2. This English Electric 11 kV switchboard feeds the furnace seen below, left. The furnace transformer has on-load tap-changing gear

Fig. 1. This 60 ton, 15 MVA arc furnace shown tilted to pour its charge, is representative of increasing sizes coming into use

These figures underline the previous remarks on switchgear duty when off-load tap-changing is used, for the average time spent on one 60 ton melt is 7½ hours. Apart from the question of switchgear, the effect of switching large blocks of load on the supply system have to be considered.

Of course, on-load tap-changing has its own disadvantages, foremost amongst them the division of maintenance effort between the switch controlling the furnace and the tap-changing gear.

Regulators

Maintenance is again an important factor where selection of regulators is concerned. Rotary regulators offer advantages of rapid response and relatively easier maintenance compared with "balanced beam" and contactor types. Mr Campbell states that in cases where this type of regulator has replaced other types, the reduction in maintenance has been very significant. It is noteworthy that this author does not consider hydraulic regulators are likely to be superior to electrical systems.

Geneva Conference

cont. from page 242

for a considerable time. However, although progress was being made, it was difficult to say more than that the idea of such a fusion reactor had not been shown to be impracticable. The question was unlikely to attain importance immediately. Admiral Strauss said: "I would regard the programme as being of such long range that it should not affect the efforts which are now being made to find and produce uranium, or the efforts which are being made, and which we are encouraging, for the production of reactors to derive electrical energy from atomic energy."

On Thursday, two papers dealt mainly with British and American developments in the application of radio-active isotopes to industrial processes. Mr P. C. Aebersold (America) referred to the direct conversion of radioactivity to electricity via various intermediary transmuters, and Dr H. Seligman, of Harwell, made particular mention of the detection of corrosion in pipes from the outside. The problem of disposal of nuclear wastes came to the fore on the same day, as did also some problems of radiation damage in materials.

Fuel Cycles

Most branches of technology have begun with a single method of performing some function. The nuclear engineer is in the embarrassing position of having many methods of power production which he can use, and comparatively little information to enable him to choose between them. One of the principal variables is that of the fuel to be used. Put simply, there are three main nuclear fuels which may be considered; that is, elements possessing the property of breaking up, with release of energy, when they are bombarded with neutrons. Starting point for all of them is naturally-occurring U235, which is, of course, found with ordinary uranium. If this is used in a nuclear reactor, the artificial fuel plutonium 239 is formed from U238. From a quite different starting point, thorium, it is possible to manufacture fissile U233 for use in reactors.

The pros and cons of these fuels, and of the precise cycles in which they may be used were discussed at the conference on Friday of the first week. The British paper at this session was presented by Dr J. V. Dunworth, of the Harwell Reactor Physics division. A nation starting on a nuclear power programme, he points out, must build either a diffusion plant to extract U235 from natural uranium, or else a reactor which can operate with natural uranium. From that point onwards a number of choices appear, and his paper is in some way an explanation of the decisions that have been made in this country.

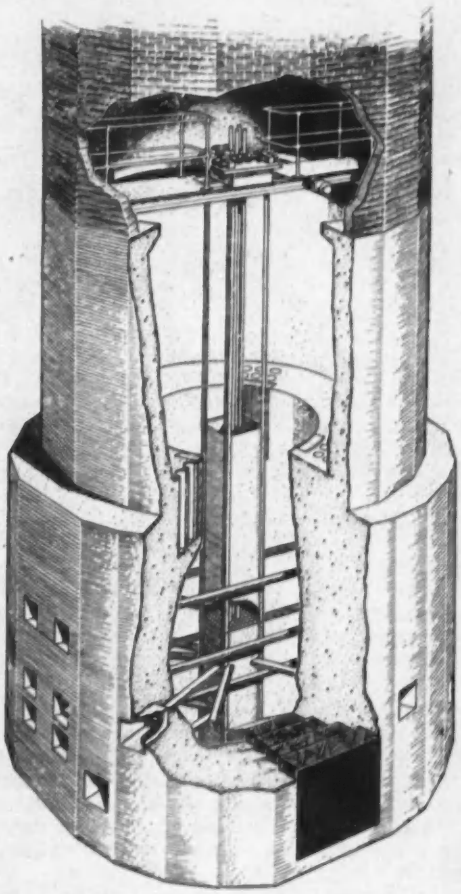
There is one possible fuel cycle which starts with enriched uranium. After the fuel elements have been used in the reactor for the appropriate period and then reconditioned in a chemical plant, all or some of the plutonium they contained at the end of their time in the reactor is put back into the core with a continuing infeed of natural uranium. Effectively, use is being made of the non-fissile U238 atoms. The conclusion to be drawn is that the need to enrich a reactor fuel is not necessarily a drawback, apart from the consideration of initial cost for enrichment can increase the conversion factor, and in the long run give the same energy per unit of natural uranium fuel. Another point is that it may be possible to divert some plutonium from the cycle without reducing by too much the total of U238 atoms consumed. Such a procedure makes plutonium available for advanced reactor designs, or for initial enrichment of new reactors in place of diffusion-plant produced U235.

It must not be thought that recycling plutonium does not have difficulties attached to it. First of all, there is the problem of getting the plutonium back into the reactor. It must either be mixed with the natural uranium infeed, in which case fuel element fabrication has to be carried out under the difficult radioactive conditions of the presence of beta particles; or else it must be put into the reactor separately, in which case a dilutent which does not absorb too many neutrons must be found for the plutonium.

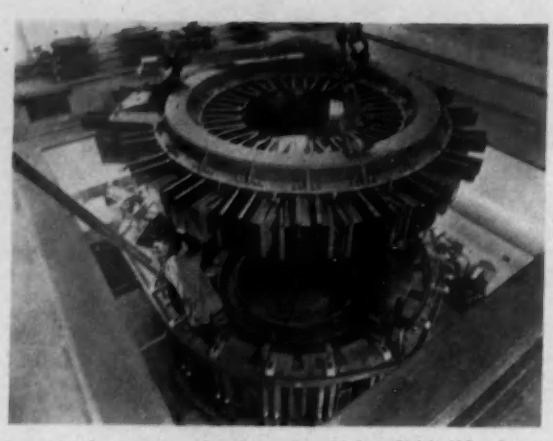
U.K. Decisions

When the production of a power producing reactor was first considered in the U.K., the short term possibilities were suggested for coolants and for moderators, assuming the use of natural or slightly enriched uranium as the fuel. After explaining the various considerations that applied, Dr Dunworth points out that the final choice was a gas-cooled natural uranium reactor, perhaps with sodium cooling as an important future development. The desirability of developing a light water moderated and cooled reactor was recognised provided reactor physics studies confirmed that such a reactor would have a good neutron economy. A further corollary was that the use of an organic liquid as a moderator should also be considered.

All the modifications possible of the selected system seem to be capable of yielding a conversion factor of 0·9 or better, provided enriched uranium is used in the fuel. The



View showing the layout of the A.E.I.—John Thompson research reactor (water moderator)



Assembly of the magnet of a Metropolitan-Vickers 300 MeV Synchrotron at Glasgow University

effect on conversion factor of fission product poisons and other developments of prolonged irradiation is at present not fully clear.

In conclusion, Dr Dunworth suggests that future high output reactor developments seem likely to be associated with two distinct types of system. On the one hand there is the reactor making use of a moderator, and of neutrons at thermal or near-thermal speeds. It seems likely that from chemical and metallurgical considerations, the thorium-U233 cycle will eventually apply to such reactors.

The alternative route is through the fast reactor, with little or no moderator, which can lead to very high gain factors using the plutonium-U238 fuel cycle, and a rather lower gain factor using the thorium-U233 cycle. In both cases some sacrifice in gain factor is likely as a method of easing engineering and processing problems.

Long-term View

A longer term view of this problem of fuel cycles was taken by Mr A. M. Weinberg, of the U.S.A. Oak Ridge National Laboratory. In his paper "Survey of Fuel Cycles and Reactor Types" he begins by commenting that the quantity of thorium in the outer surface of the earth appears to be three times the quantity of uranium. It is less certain, however, whether workable deposits are more common. Once the fuel has been found, neutron economy, which Mr Weinberg describes as the conversion efficiency from one fissionable isotope to another, has to be considered. In thermal reactors where plutonium is being produced from U238, the important economic question is, how long can a fuel element run without requiring reprocessing? It is usually considered that this requires 0·3% of all the atoms in the fuel element to be burnt before reprocessing.

At this stage the paper plunges into highly technical considerations concerning neutron life history. It emerges from these with the following conclusions:

1. Thermal breeding in the thorium-U233 cycle has a fairly good outlook, with breeding gains of 10 to 15% probably achievable.

2. The homogeneous breeder reactor has the advantage that it is not subject to heavy neutron loss through poisoning with xenon. If fission products can be removed continuously, this advantage will be still further increased.

3. Fast breeding in the uranium-Pu239 cycle looks promising. Breeding gains of 0·5 should be possible, provided the neutron energy can be kept high.

4. Fast breeding in the thorium-U233 cycle is possible, but has little advantage from the nuclear aspect over the slow thorium-233 cycle.

5. There is only a poor chance of breeding using intermediate speeds in neutrons. Fission poisoning would probably be particularly difficult.

Losses of reactivity are probably tolerable for fuel burnup amounting to 3,000 MW-days/ton.

The question that obviously arises is whether in the long run some single type of reactor design will appear as so distinctly superior to all others that it will make these others obsolete. In the opinion of Mr Weinberg, this is improbable. Reactors will be more like dams, and provided their overall operating costs remain low enough, there is no reason, once they are built, why they should become obsolete any more than does a dam.

In a third paper in this group, Dr W. B. Lewis, of Canada, describes a fuel cycle in which all the uranium remaining after separation of the plutonium and of fission products is returned to the reactor. This may be done up to three times, the uranium growing weaker and weaker in U235, but still generating Pu239 due to irradiation. The more highly depleted uranium will have to be left in the reactor for a long period. Dr Lewis presents detailed cost analysis for the various operations necessary in such a cycle as against cost of electricity generated. The reactor involved in such a cycle would be heavy water moderated. The reactor would also have to be relatively large to limit neutron escape. It is estimated that 0·9 fuel regeneration is attainable, all that is likely to be needed.

In the discussion on the three papers, the different approach of the U.S.A. and G.B. in concentrating on liquid and gas cooling respectively was underlined. The Americans seem impressed by the electricity output per ton of uranium being claimed for the proposed improved Calder Hall type of reactor, though they still hold that the best liquid cooled reactor makes better use of materials than the best gas cooled design.

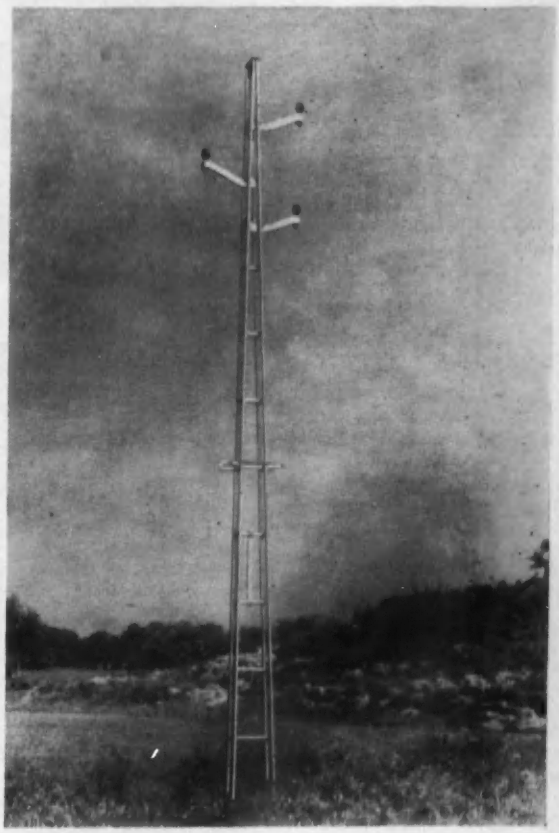
It was also emphasised that the rate of breeding thorium was rather slow, and that if use of nuclear power expanded at the expected rate, thorium-U233 reaction would not be able to supply all the fissile fuel required. It was further stated that although the fast breeder gives the highest positive conversion factors, it does not necessarily make the best use of materials. Thus in the early stages of an expanding programme, it may be better to give attention to thermal reactors from the point of view of securing the greatest amount of nuclear based electricity from a given amount of fuel.

TABLE 3.—CALDER HALL ESTIMATED COSTS

	Capital Charges	Annual Charges	Cost of Electricity at 80% load factor d/kWh
	£ millions	£ millions	
Reactor Items	7·5	0·68	
Other Plant	11·3	0·69	
Total Construction ...	18·8	1·37	
Cost of Initial Fuel Charge at £20,000/ton	5·0	0·20	
Total cost	23·8	1·57	0·36
Operating Costs:			
Site Operating Costs ...		0·26	
Cost of replacement cartridges at £20,000/ton ...		1·46	
Total operating cost ...		1·72	0·40
Total gross cost... ...		3·33	0·76

(*to be continued*)

New Overhead Line Pole Uses Tubular Steel Construction



Neatness and elegance characterise the pole seen on the right

A NEW overhead line pole for use on distribution and transmission lines where supports do not have to withstand heavy mechanical loading, has been developed by Painter Brothers Ltd., of Hereford, in collaboration with British Insulated Callender's Construction Co., Ltd. It will be known as the P.N. pole.

In its design full consideration has been given to the need for economy, lightness and simplicity of construction. These features have been achieved by fabricating the pole from standard commercial sizes of small-bore steel tubing and adopting a bracing system which permits a break-down of the complete pole into component pieces. This, in turn, results in easy transportation and enables the assembly and erection of the poles to be carried out with the minimum of skilled workmen and supervision.

The pole is made in two sizes, 30 ft and 35 ft overall length, designed for a depth below ground level of 5 ft and 5 ft 6 in. respectively. The transverse face tapers from ground line to peak to form an "A" frame with a reverse taper below ground to provide an efficient foundation. Longitudinally the tubes are parallel.

Pole Construction

The pole is made from four steel tubes of 1 in. nominal bore by 12G to Class "A"—B.S. 1387. The tubes forming each longitudinal face are connected at intervals by batten plates welded to the tubes and to these battens are bolted spacers, made from rolled steel flats to form "I" sections, which connect the two longitudinal frames together to make the complete pole.

The two longitudinal faces are fastened together at the top by a locking unit and a cap plate which are connected by a through bolt or insulator spindle. The cap plate also serves to seal the ends of the tubes from the atmosphere.

All structural parts are hot dip galvanised, bolts being hot dip spun galvanised. The tubes are left open during the galvanising and are therefore protected both inside and outside.

The pole has been designed for an ultimate head load not exceeding 1,250 lb at the pole top, and has been subjected to full scale comprehensive tests so that poles are of a guaranteed known strength. Particularly suitable for tropical conditions, these poles will support a wide range of conductors on spans varying between 250 ft and 350 ft depending on conductor size and material.

The pole so far described is not suitable for use as a strut and it cannot, therefore, be used as a stayed structure. A pole for this purpose, of similar construction and embodying the same features, has been successfully proof tested for use at angle and terminal positions.

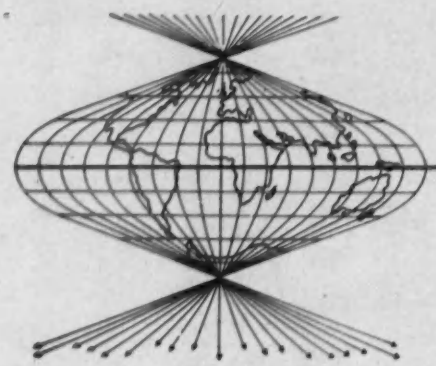
ELECTRIC MOTORS UP TO 500 H.P.

FOR many years Brook Motors Ltd. have manufactured alternating current electric motors up to 250 h.p. but in view of the demand this range has now been extended to a maximum of 500 h.p. ventilated and 350 h.p. totally enclosed in both cage and slip-ring types and new plant to deal with the machining of larger castings has been added to the equipment in the large motor section of the Huddersfield works. The standard construction of cast-iron yoke and endshields has been maintained but design has enabled the ratings to be produced in extremely compact frames.

The Drip-proof design has eight ventilation ports with loose louvres and blanking plates in each endshield; by rotating these through 90 degrees, drip proof protection can be obtained in whatever position the motor is mounted. Medium type ball and roller bearings are fitted, these are contained in cartridge housings which enable the rotor to be removed without disturbing the bearings. On the totally enclosed fan cooled design a unique method of internal and external fan cooling has proved a most efficient form of heat transference.

Cage rotors are all of the double cage type which limits the starting current to not more than six times full load. Slip-ring rotors are bar wound throughout and have extra large brushes. They are all fitted with short circuiting gear, and can also be supplied for brush lifting.

All castings and materials are in generous proportions to ensure that these motors will work in difficult applications of loading and duty and all rotating parts are dynamically balanced. Both types may be obtained with or without feet, for flange mounting, or with third bearing and bedplate for wide belt application, and are offered for a.c. supply up to a maximum voltage of 600.



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

U.S.A.

Long Distance Coal Piping

Plans to build a 108 mile pipeline to transport coal from Georgetown, Ohio, pithead to the generating station at Eastlake in the same state have been announced by a Pittsburg coal company and the Cleveland Electricity Corporation.

Three railway companies who at present carry the coal, the New York Central, the Pennsylvania and the Nickel Plate are participating in the pipeline. The line will also convey fine coal. Mixed with equal quantities of water into a slurry the coal will be pumped through a 10¾ in. pipe by three pumps positioned equally along the line. The slurry will be moved along the pipe at three miles an hour and will be dried on arrival. About 1,200,000 tons of coal will be moved per year by this method.

In Britain piping of coal from pit top to washery is already in practice at Markham Colliery (where coal from 2 in. cube downwards has been moved successfully) whilst an experimental installation for pumping coal from pit bottom up the shaft has proved successful at a Scottish colliery.

Harnessing the Tide

The possibility of harnessing the tides in the Bay of Fundy, between Maine and New Brunswick for hydro-electric power would appear to have come a stage nearer reality. U.S. Congress has made an appropriation of over £1m for a thorough study of the scheme. The investigation is to be undertaken under the Canadian-American International Joint Commission. Reason for the interest in the Bay of Fundy is that the drop between high water mark and low is as much as 56 ft in places on the spring tide. Differentials of 40 ft are common.

CANADA

Power Output

The latest monthly report on central electric stations in Canada, issued by the Dominion Bureau of Statistics, shows that power output in May reached a new record in Canada at 6,640 million units —the previous highest total was reached in March at 6,635 million units. While the output increased to a new record, the significant figure of primary consumption, while well above any previous May, was not a new record, having been surpassed last Dec., as well as in Jan. and March of this year. Primary power consumption is defined as production plus imports, less exports and secondary power. Biggest gain over last year in power output has been shown in Ontario. In May the increase in Ontario was 537 million units to 2,235 millions. In Quebec the gain was only 68 millions to 3,220 millions. In the five months, the Ontario increase was 2,379 millions to 10,716 millions, while the Quebec gain was 989 millions to 15,226 millions. Quebec, however, still continues as by far the largest producer in Canada. Its output is equal to nearly as much as the combined output of all the other provinces.

EUROPE

Village Facilities

Increasing numbers of villages in Poland are having electricity, radio, and telephone laid on according to the latest statistics. In over 4,300 farmsteads and in two state farms in Rzeszow voivodship electric light has been installed this year. By the end of the year 3,000 more farmsteads will have been connected to the electricity network. The overall figure of electrified farmsteads will thus have topped the 40,000 mark, while the number of villages provided with electricity will be almost 300. Up to the end of 1939, only forty villages, situated mainly in the vicinity of towns, had been electrified in this voivodship, it is stated. Fifty villages in Kielce voivodship will have electricity laid on this year, including some 4,700 farmsteads. Up to now, over 600,000 radio loudspeakers have been installed in the Polish countryside. There are some fifty-five loudspeakers and valve sets to every 1,000 villagers. A further 200,000 loudspeakers will be installed in villages, co-operative and state farms this year.

Picote Scheme

Work on Portugal's latest hydro-electric project, the Picote, is proceeding satisfactorily, it is reported. At the moment, all efforts are centred on constructing the 100 metres high dam, and the adjoining 200,000 kVA power station. A great deal of the preliminary work, including the building of a large covered space comprising office buildings, dormitories, canteen, first-aid hospital, warehouses and workshops, has been done. A suspension foot bridge, joining the Portuguese and Spanish sides of the river has been erected and about 130,000 cubic metres of earth and rock have been moved and approximately 100,000 cubic metres of supporting walls built. Besides this, 27 km of high tension transmission line have been erected from the Spanish generating station at Castro to supply workshops, machinery, etc., on the Picote site with power.

U.S.S.R.

400 kV Grid

Some details of a distribution system covering the whole of European Russia, and eventually the whole of the Soviet Union, were given by Mr Georgi Malenkov, Russia's new Minister of Power Stations. The European network is to be ready within five or six years, that is by the end of the next five-year plan which is due to start next year. Main link in this new grid will be a 400 kV line between the Lower Volga and Moscow, a distance of some 600 miles. According to the Soviet Press two h.t. lines will link the capital with Kuibyshev hydro-electric power station, scheduled to start operation at the end of this year, and with the Stalingrad station which is to be commissioned in 1956.

The Kuibyshev-Moscow line is expected to carry over half the average annual consumption of the Kuibyshev station. It will be supported by 4,200 towers nearly 90 ft high and cross a total of 30 rivers. Russia has some 50 regional power systems and the European grid will comprise three of them—the Urals, the Southern and the Central systems, the last being the largest in the country. The establishment of a distribution network over the whole of the U.S.S.R., said Mr Malenkov, was a "matter for the more distant future."

INDIA

Another Board

A fifth State Electricity Board has been formed in India—this is for the use of West Bengal. The Government has nominated seven members to constitute the Board, with Shri D. N. Mitra, of Calcutta, as its chairman. Other members include Shri H. C. Guha, Prof of Electrical Engineering at the College of Engineering and Technology, Jadavpur,

and Shri A. K. Bhaumik, B.SC.(ENG.), M.I.E.E, chief electrical engineer to the Government of West Bengal The other four State Electricity Boards so far constituted are for the states of Delhi, Madhya Pradesh, Saurashtra and Bombay.

Inquiry at Rajasthan

The Government of Rajasthan, India, has set up a committee which has been empowered to enquire into the condition of privately-owned power houses in the State. The committee, apparently, have been requested to report on recommendations which should be taken for the proper functioning of these power stations. But the local private undertakings consider that an unbiased inquiry into the operation of the State-owned generating plant is more urgently needed.

Railway Electrification

Inaugurating the Deccan Railway Conference, Railway Minister Mr Lal Bahadur Shastri said that the Igatpuri-Bhusaval line on the Central Railway would be electrified soon. Increasingly heavy traffic on the line had brought about the need for electrification.

Exporting Plastics

An Export Promotion Council for Plastics has been set up in India. Its immediate purpose is to collect statistics and other information regarding the manufacture or trade in plastics in other countries, to lay down standards of quality and packing for export plastics, and to investigate any complaints from overseas importers. In recent years, India's plastics industry has developed considerably, and in 1954-55 exports of plastic goods were valued at more than Rs. 1·4 millions.

AUSTRALIA

Bulk Arrangement

The Renmark Irrigation Trust is in future to take a bulk supply from the Electricity Trust of South Australia and close down its own power station. The two organisations have now reached an agreement on the matter after several years of negotiations. The Irrigation Trust began its electricity undertaking about 20 years ago when all of its steam pumps were converted to electricity and power was made available to the district. This local plant is to be retained for use in an emergency, we understand, meanwhile with more power available, the local residents will be able to use appliances previously restricted because of overloading.

Expenditure on Railways

The New South Wales Railways Commissioner, Mr Winsor, has proposed that the Australian and N.S.W. Governments engage, over the next 10 years, on a programme to improve railway services to meet major competition on the roads. Under the plan put before the N.S.W. Government, the Commissioner suggested that consideration be given to a £A200m programme, including the spending of about £A60m on more than 400 diesel-electric locomotives. The Commissioner has also proposed that the Federal Government should spend £A50m in the 10 years, spread among all States, for the improvement of railway services.

NEW ZEALAND

Power Quotas

Dissatisfaction with the method of power allocation adopted by the State Hydro-Electric Department, N.Z., was recently expressed at a meeting of Electric Supply authorities in North Island. They urged that power allocations to all N.I. authorities should be based, not on estimated requirements as compiled in 1953 but on actual consumption in the year ended 31 Mar., 1955. The latter was a year of unrestricted sales by all authorities, and in their opinion, would give a much simpler and fairer measure of basic allocations. The authorities also approved a resolution urging the Government to greater action in solving the power shortages in the North Island.

Problem of Fuel

Another suggestion for easing the North Island's power position has been made by Mr J. S. McAlpine, president of the New Zealand Manufacturers' Association. He suggested that packaged power plants should be obtained from the United States, in addition to the large coal-fired station contemplated. But Mr W. S. Goosman, Minister in charge of the State Hydro-Electric Department, has emphasised that the necessary fuel is a major problem. Coal production at Huntly is under 800,000 tons a year. The proposed 180 MW station would require more coal than Huntly could produce. Additional supplies are essential.

There are now strong hopes that the Whakamaru hydro-electric station on the Waikato River, New Zealand, will be operating next year. The pace of constructional work has been increased, and as our illustration alongside shows, the 3,000 ft long dam is rapidly nearing completion. The fourth of ten stations in operation or projected for the Waikato River, Whakamaru, is to have an installed capacity of 100 MW. The Metropolitan-Vickers Electrical Co., Ltd., are supplying the four 27,777 kVA generators which will run at 136 r.p.m. and generate at 11 kV. The associated water turbines, which are being provided by the Dominion Engineering Co., of Canada, will operate on a head of 120 ft. Power will be fed into the 220 kV transmitting station which has already been established a few hundred yards away from the site

Personalities

IN THE INDUSTRY

The election of **Mr Thomas G. Ellison** as chairman of the directors of George Ellison Ltd., Tufnol Ltd., and of Alfred Ellison Ltd., was announced last week-end. He succeeds his father, the late Mr George Ellison, whose death occurred a short time ago. The new chairman's two brothers, Mr George Ellison and Mr John Ellison, and Mr Arthur E. Skan, continue as directors of all three companies.

A number of changes in the organisation of North Staffs sub-area of the Midlands Elec. Board have recently occurred.

Mr H. McCartney, A.M.I.E.E., Senior Assistant Engineer at North Staffs sub-area headquarters, has been appointed manager of Stoke South District in succession to the late Mr F. R. Ward.

Mr R. J. Gent, A.M.I.E.E., district engineer at Leek, has gone to sub-area headquarters as Senior Assistant Engineer (operations). His successor at Leek is **Mr J. S. Baigent,** previously district engineer at Stone.

The Stone and Market Drayton districts have been combined and **Mr L. Harvey,** A.M.I.E.E., district manager of Stone, takes charge of the combined district. **Mr W. N. Pritchard,** district manager at Market Drayton, becomes deputy district manager of the combined district. **Mr K. A. Morgan,** A.M.I.E.E., district engineer at Market Drayton, becomes first assistant engineer at Stoke South, replacing **Mr G. H. Kelsall,** who is now district engineer of the combined Stone/Market Drayton district.

Mr G. L. Brown, District Consumers Engineer at Stone, becomes District Consumers Engineer of the combined district with **Mr C. J. Moore,** formerly district consumer engineer at Market Drayton, as deputy.

Mr L. E. Geering and **Mr A. W. Putnam** have been appointed directors of the Carrier Engineering Co., Ltd.

Mr Christopher E. G. Bailey, M.A., M.I.E.E., has been appointed technical director of Solartron Electronic Business Machines Ltd. and will also act in a general advisory capacity on research and development work to the Solartron Electronic Group for whom he has been a consultant over a period. Born in 1906, Mr Bailey was educated at Gresham's School, Holt, Norfolk, and Balliol College, Oxford, where he read physics. In 1928 he joined The Gramophone Company Ltd. (now E.M.I.) as a radio engineer. He then joined the Plessey Co., Ltd., as the firm's first radio designer. After a period with the Philips organisation both in England and in Holland where he was in charge of the communication laboratories at Hilversum and escaped the German invasion, he returned to England to run a laboratory group for Mullard Ltd. He was largely concerned with the Radar Countermeasures Unit of the Government Telecommunications Research Establishment.

After the war he went to Sweden to direct a laboratory of the Royal Swedish Air Board and did much to establish Anglo-Swedish co-operation in radar development. He returned to this country in 1952 and set up as a consultant. His work with the Solartron Group will be concerned initially with business electronics, radar and computor development and with radar simulators.

Mr F. B. Duncan has been elected deputy chairman of British Relay Wireless and Television. **Mr G. H. Martin** has retired from the Boards of the company and its subsidiary companies and is no longer connected with the group.

Mr E. C. Whiteley, whose experience in overseas countries has been gained through continual travel over 15 years since 1930, has been appointed manager of their Middle East Division, by the Metropolitan-Vickers Electrical Export Co., Ltd. He retains his responsibilities in connection with the company's wide interests in the petroleum industry to which he was assigned on his return to this country in 1945. Educated at Manchester grammar school and Manchester College of Technology, where he was offered a scholarship to Manchester University, Mr Whiteley joined Metrovick as a school apprentice in 1920. For some time he specialised in electric traction but later transferred to the sales side.

In 1930 he was appointed technical representative in Malaya, and during the next 12 years travelled extensively in the Far East. Mr Whiteley then spent three years in Australia as works engineer and acting works manager of the Australian General Electric Co.'s works in Melbourne. While in that country he became an associate member of the Instn. of Production Engineers, and an associate Fellow of the Inst. of Industrial Management (Australia).

Brigadier F. C. Wallace, D.S.O., M.C., has joined the board of Decca Radar (Canada) Ltd. Brig Wallace, who is president of Canadian Pittsburg Industries, Ltd., Smith and Stone Ltd., and executive vice-president of Duplate (Canada) Ltd., was a leading figure in the Canadian radar field during the war when he was director of the radio division of the National Research Council and was responsible for radar production at Research Enterprises Ltd., a Crown company, as well as occupying a key position in the military radar field.

New branch manager of British Insulated Callenders Cables Ltd. at Chester is **Mr E. Watt** who has been with the group for 38 years.

Mr Watt was educated at Old Trafford Technical School and in October 1917 joined British Insulated Cables Ltd. in the Manchester branch sales staff. In this capacity he has had a long and close association with local heavy industry and the electrical trade. His sales territory included the North Wales area and was closely identified with the initial electrification of many collieries in the North Wales coalfield.

Mr T. G. Ellison

Mr E. C. Whiteley

Brig F. C. Wallace

Mr E. Watt

Mr C. E. G. Bailey

Changes in N.E.C.T.A. representation on the Electrical Fair Trading Council have been announced. **Mr W. T. Trace,** of W. H. T. Trace and Son Ltd., Birkenhead, has resigned and **Messrs J. G. Briggs,** of Electrical Installations Ltd., S.W.1, and **H. S. Wathes,** of T. H. Wathes and Co., Ltd., Leicester, are now representing the Association.

Mr J. M. Fichter, of Mullard Ltd., celebrated last month twenty-five years' service with the company. On the commercial side of the business Mr Fichter is a well-known personality in the radio component world. Amongst his other activities he has represented Mullard Ltd. at B.V.A. meetings for many years. To mark the occasion the directors of the company entertained Mr and Mrs Fichter to lunch recently when Mr S. S. Eriks, managing director of Mullard Ltd., presented Mr Fichter with a gold watch and a cheque on behalf of the board of directors.

Mr Eriks, Managing Director of Mullard, (right) makes the Jubilee presentation to Mr J. M. Fichter

The Minister of Fuel and Power has appointed **Mr Forbes Jackson,** M.I.MECH.E., M.I.E.E., of Earley, Reading, as a part-time member of the Southern Electricity Board; **Mr H. G. Partridge,** M.A., of Cardigan, as part-time member of the South Wales Electricity Board with effect from 1 Aug., 1955; and **Cllr. H. Preece,** of Coven, Wolverhampton, as Deputy Chairman of the Midlands Electricity Consultative Council with effect from 15 Aug.

Mr Forbes Jackson who retired last November from the position of deputy engineer in chief to the London County Council is well known in the industry. He has been prominent in the activities of the I.E.E., being chairman of the Installations section in 1945-46 and representative of the Institution on the N.R.E.I.C. in 1945. He was a member of the M.o.W. Post-War Building Studies Committee for electrical installations and of the I.E.E. Codes of Practice Committee. In 1949 he was president of the Batti-Wallahs Society.

Mr Malcolm E. Bradden, of Toronto, has been appointed rehabilitation and information officer for the St Lawrence Power Project, according to an announcement from the Ontario Hydro Commission. Mr Bradden will set up his headquarters in Morrisburg and in addition to providing information he will assist families being relocated as a result of the power project.

Mr D. Priest has now taken the post of production superintendent of the electronics production section at the Skegness factory of Murphy Radio Ltd. Before the war, Mr Priest was with Dorman Long and Co., Ltd., Middlesbrough and joined Murphy Radio after service with the R.A.F.

General manager of Heat Exchangers Ltd., **Mr G. D. Toogood,** A.M.I.MECH.E., has been elected a director of the company.

Mr Felix Singer, M.I.CHEM.E., and Fellow of the American Ceramic Society, has accepted three months' appointment from the United Nations Technical Assistance Administration as an expert in ceramics in Yugoslavia. Mr Singer's appointment will be a continuation of work he undertook in Yugoslavia last year. He spent several months advising Yugoslav firms on the improvement of the production of h.t. insulators for the growing electrical industry. During those months it was found possible to increase production of insulators materially and to reduce breakage in manufacture. He believes that Yugoslavia will be able to meet her own needs for electro-insulators and enter the export market.

Mr Singer, who comes from Croydon, has been a consulting ceramist in Europe, Canada and the U.S. for over 20 years. He takes up his new appointment this weekend.

Mr C. E. Lupton, formerly statistical accountant of the United Steel Companies Ltd., has been appointed secretary and office manager of Samuel Fox and Co., Ltd., Blocksbridge.

Mr C. M. Spielman has been appointed chairman of Whessoe Ltd. in succession to **Mr H. G. Judd,** who has retired after holding office for 35 years. Mr Judd remains on the Board.

New manager of Merthyr Motors Ltd., Cyfartha, Glamorgan, the large transport organisation of Hoover (Washing Machines) Ltd., Merthyr Tydfil, is **Mr J. I. Plenty.**

Mr S. P. Cheesman, a popular figure in the accounts section of the Mid-Sussex Sub-Area, S.E.E.B., was the recipient of a presentation at the Hove St billing office on the occasion of his retirement after 46 years in the supply industry, 39 of them with the Brighton Corporation undertaking.

OBITUARY

The N. of Scotland Hydro-Electric Board lost a tireless worker, an outstanding engineer and an able administrator on the sudden death in Edinburgh last Saturday of **Mr Thomas Lawrie,** C.B.E., M.A.(CANTAB.), M.I.E.E., M.I.MECH.E., F.R.S.E., their general manager. He was 54. A son of the manse, Mr Lawrie was born at Laurencekirk, Kincardine, and educated at home, Mackie Academy, Stonehaven, Leighton Park School, Reading, and at King's College, Cambridge. Leaving the University, where he took the Mechanical Sciences Tripos in 1923, he started his career with the English Electric Co., as an apprentice at the Stafford Works and also worked in the Montifieth Foundry, Dundee, and Fore River Shipyard, Boston, U.S.A. He later spent three years with their hydro-electric section before becoming secretary of the Power and Traction Finance Co., Ltd., He was associated with the Sudan Light and Power Co. and later he was concerned with the promotion of the Galloway Water Power scheme and was secretary of the Galloway Water Power Co. between 1931-1940. During the war, Mr Lawrie served as a lieutenant-commander in the R.N.V.R. It was on his release in 1943 that he joined the N. of Scotland Board as Secretary and contributed a vast amount to the Board's initial successes and subsequent progress. He became general manager in 1948. Scotland's hydro-power schemes will be a permanent memorial to Mr Lawrie. His cheerfulness and kindness on all occasions and most recently during the I.E.E. Summer visit will be missed by all who have met him. Mr Lawrie leaves a widow, two sons and three daughters to whom we offer our most sincere sympathy.

The death is announced of **Lord Ramsden,** O.B.E., aged 72. Lord Ramsden was a well-known figure in public life and especially in Conservative political circles. Active in the world of trade and commerce Lord Ramsden was for many years chairman of A. and S. Henry and Co., Ltd., director of the Monotype Corporation, the Yorkshire Electric Power Co., Ltd., and Lloyd's Bank.

He was a director of the former British Insulated Cables Ltd., and continued a director after the merger in 1945 with Callender's Cables Ltd., until June, 1954, when he retired owing to ill-health.

The death has occurred after a short illness of **Mr H. Kelvin Parsons,** managing director of Gent and Co., Ltd. He was 53. Mr Parsons died at his home at Oadby, Leicester, on 11 Aug. Well known in the electrical trade and horological industries, he was a Freeman of the City of London, a Fellow of the British Horological Institute and an Associate Member of the Railway Signal Engineers. Educated at Uppingham and Cambridge, Mr Parsons joined Gent and Co., Ltd., in 1923, was appointed a director in 1931 and managing director in 1946.

PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

"Feedback"

ONE often comes across faults where the trouble being experienced—overheating, sparking and the like—is not due to trouble in its own circuit but to cross-feeding, as it were, from an adjacent circuit or its components which are badly sited. A recent case experienced by the writer concerns two three-phase motors, each driving a sewage pump, the two pumps being designed to operate in parallel.

Normally, one pump is capable of dealing with the sewage load, but should a fault develop in the pump in use or the volume of sewage increase so that one pump alone cannot handle it, the second pump is automatically brought into operation. Both motors are controlled by float switches and automatic-rotor starters—of the contactor type—the various steps in the rotor resistance being cut out by terminal delays, and the two starters being mounted on a common panel.

On the occasion in question, when both units were reported as faulty, No. 1 pump was found running at reduced speed, whilst No. 2 pump was stationary, although the sump was overflowing. Examination revealed that the overload trip on No. 2 motor had operated, thus putting the pump out of action. Further investigation revealed an open-circuit in the thermal delay operating on the first rotor contactor, and consequently the motor was running with all its rotor starting resistance in circuit. These resistors, therefore, became heated up, and since they were located at the rear of the panel immediately behind the thermal o.l. trip for No. 2 motor, the heat from these units was sufficient to operate the trip. Hence the fault on No. 1 equipment actually succeeded in putting the standby unit out of action. As well as repairing the faulty time delay, the resistors themselves were repositioned behind their respective panels.—*D. E. H.*

Mysterious Volts

SOME time ago I was asked to install a 15A heating point in a flat, and supply a 2 kW heater. The general installation was in lead covered cable, so I used lead cable for the plug. I terminated at a 15A, s.p. and n. switch fuse, and was asked by the customer to fix the plug top on the heater, and leave it all ready for connection by the Supply Authority.

Within an hour of returning to my place of business, a phone call was received from the customer stating that she had received a severe shock from the case of the heater. This as you can imagine rather puzzled me as the plug was not connected to the supply. However, when I returned, I learned that the heater had been plugged in, and stood in the hearth, and when the metal fireplace was touched at the same time as the heater, the shock was received. Imagine my surprise, when I connected a test lamp between the earth terminal of the plug, and the fireplace, and the 100 W lamp, lit with almost full brilliancy. I turned off all the main switches in the flat with no avail.

The trouble was eventually traced to the flat above, and was caused by a faulty floor plug circuit wired in lead cable that had gone down to earth, and was not bonded. I had to bring in the Supply Authority's inspector, to convince this irate tenant that her installation was a potential danger to the tenant below and possibly others in the block. After getting in touch with the owners of the flats, all the installations were tested and the various faults located were rectified.—*A. R.*

Trunking for Choice

A GREAT many of the smaller types of screwed conduit installations, although quite sound generally, appear to suffer at the meter position from a collection of inspection bends, tees and exposed cables. A typical example of this I observed in the very interesting article on the adaption of an existing church heating system (28 July issue). All that is necessary to make a clean job at this particular point of the installation, is a short length of 2 in. by 2 in. trunking, on to which, all the various pieces of switchgear, time-switches and the like, can be made. To take this particular instance an arrangement using trunking of a standard type would have been an improvement.

Practically all the exposed cables would then be covered, future additions could be made more easily and the meters installed on top of the trunking, a slot linked with a grommet being left to accommodate them. As regard costs, the present arrangement of bends and tees would probably be around the same as say a 3 ft length of 2 in. by 2 in. trunking. It is also an ideal method of using up odd lengths of trunking left over from larger jobs.

Another item which is difficult to incorporate in a screwed conduit installation is certain types of refrigeration control gear, particularly thermostats. A lot of these are only equipped for the entry of t.r.s. cables usually through a knock-out in the "Bakelite" case. One often observes these mounted on a wall with the conduit terminated by a brass bush, leaving the v.r.i. cables exposed between the conduit and thermostat entry. The method I use to get over this problem is to terminate the conduit in a suitably-sized adaptable box and take the cables back entry into the thermostat, using the box lid for the thermostat mounting.—*W. Satchwill.*

Three-phase Measurements

IN field tests of power or energy consumption in three-phase, three-wire circuits, the major difficulty to be overcome is that of obtaining the correct voltage to apply across the pressure coil of the instrument. Where such measurements have to be made quite often it is worthwhile to obtain an auto voltage transformer, wound for the line voltage, and provided with a 50% tap. To carry out measurements, the current coil of the instrument is connected in one line, and the voltage coil between this line and the 50% tap on the auto-transformer, which is connected between the other two lines. As the voltage on the wattmeter is $\frac{1}{2}\sqrt{3}$ of the line voltage, the instrument indicates exactly one half of the total power in a balanced load, subject of course, to any multiplier where a current transformer is being used.

The apparatus can be further improved by providing an 86·7% tap on the voltage transformer. If the wattmeter leads are then connected across this 86·7% tap (i.e., one lead to the end of the auto-transformer and the other to the 8 tap position on the winding), the value of the voltage will be unchanged, but its phase will be shifted by 90° and the instrument will then read one half of the kVA consumption. The ratio of the two readings gives tan ϕ, from which cos ϕ the circuit p.f. can be calculated. For useful approximations, however, when tan ϕ is $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$ and 1, the p.f.s are, roughly, 0·95, 0·9, 0·8, and 0·7 respectively.—*M. D.*

Simple Starter Check

BURNT or rough contacts may hold a starter closed even if the no volt release has operated correctly. For these reasons it is best to test all control gear automatic releases frequently. This is quite a simple operation, and merely involves cutting off the supply when the motor is running, or raising the overload trip, or pressing the remote "stop" button and ascertaining if the starter gear is released.—*W.M.J.*

Measuring Soil Thermal Conductivity

E.R.A. WORK IN CONNECTION WITH CABLE RATINGS

THE rating of a buried cable is largely dependent on the rate of heat dissipation, and for the calculation of heat flow it is necessary to determine the thermal resistivity of the soil. For most practical purposes an accurate determination is not necessary, and, indeed, a single accurate figure is impossible to derive as thermal resistivity varies considerably with the moisture content of soils and this fluctuates throughout the year.

The hitherto accepted method of measurement has been to place a spherical or cylindrical heater in the ground, to apply a constant heat input to the heater, and to measure the temperature rise at selected points. This method has several advantages but requires several days of costly field measurement for each site investigated and there is consequently a need for quicker and less expensive methods. Two other systems have, therefore, been investigated by the E.R.A. A general assessment of the three systems is presented in Technical Report F/T181 "Methods of Determining the Thermal Resistivity of Soil *in situ* for the Calculation of Cable Ratings."

Alternative Systems

The first of the other methods uses a "transient needle" in which a long thin heater is placed in the ground and heated for about 15-20 minutes, the thermal resistivity being calculated from temperature and time readings. This technique has been used in this country and abroad in connection with cable ratings with satisfactory results. Field measurements by the E.R.A. confirm that readings obtained by this method are within ±10% of the sphere measurements.

The second method assesses thermal resistivity from soil constitution and moisture content as determined from a sample suitably taken. This method has so far been developed only for soils of clay, sand, or a mixture of these.

A note of warning is sounded in that the apparent thermal resistivity of soil in which a cable is laid may under some circumstances be greater than the thermal resistivity of the surrounding soil because of the effects of migration of moisture away from the heated surface of the cable. The sphere method, if measurements are continued over a sufficiently long time and at the appropriate season takes some, although not exact account, of this phenomenon. The other two methods give the thermal resistivity of the undisturbed soil.

Advantages of the Systems

The Report continues by describing the theory, the equipment and the test procedure adopted for all these methods. A critical appraisement is given in which it is pointed out that the sphere method has the advantage that its theory is simple and direct, and it therefore gives reliable and accurate results if enough precautions are taken. It can also be used to measure thermal diffusivity of the soil and may give indication of possible difficulties from moisture movement under thermal gradient. If, however, accurate results are to be obtained in practice, time must be allowed after installation of the sphere for the soil to settle following the disturbance. Steady temperature is attained only 5 to 7 days after switching on the heaters. In all, some weeks may elapse before results are obtainable. Even if approximate methods are used, the results cannot be obtained in less than 3 to 4 days, and for a survey in detail, a fairly large number of spheres is required with associated equipment for constant power supply and temperature measurement.

The needle method gives an immediate determination of thermal resistivity from first principles, but no information is provided on the nature of soil, and the range of seasonal variation of thermal resistivity cannot be directly determined from the result of a single measurement. The method involves rather precise measurements under field conditions and skilled staff are required.

Soil sampling is only applicable to soils of sand or clay or mixtures of these, but has the advantage that samples can be rapidly taken from a trench or from the surface by means of a robust tool. No measurements are made in the field and results can be made available in 7 to 10 days' time. While skill is required in choosing sites and in the laboratory analysis of soil, organisations accustomed to such work probably exist in every county and basic data on probable seasonal variation and other factors may be obtained from existing authorities.

Cost

The cost of the three methods may vary considerably according to local conditions. In general the cost of the two rapid methods is about the same and is much less than that of the sphere method.

With the sphere and with the needle method there is a possible initial outlay on the temperature measuring and control equipment if these are not already available, but whereas the current through the needle during a short test can be controlled by hand, the value of the sphere current, although less critical than in the needle method, has to be stabilised over a long period, thus additional equipment is needed. The cost of the sphere is several times that of the needle and whereas one needle can be used for a survey of a whole cable route, several spheres are needed to cover a similar number of points in a reasonable time.

"Needle" probes are available commercially. One skilled technician and one or two labourers preparing openings in the soil should spend about 45-60 minutes for each point at which measurement is taken, including setting up the equipment and calculation of results.

With the sample method, there is an initial cost of a sampling tool and a soil borer. One responsible technician and two or three labourers should be able to collect four samples per hour in the field providing sampling points have been fixed and are easy of access. About one hour per sample is afterwards spent by a junior technician at the laboratory for weighing and drying the sample. Drying itself lasts about one week, but analysis of the bulk samples takes longer and must be done by skilled staff.

The Report contains full technical details of the equipment involved and gives the necessary nomograms and conversion data. It is available from the E.R.A., Thorncroft Manor, Dorking Road, Leatherhead, Surrey. Price 15s.

Equipment for Industry

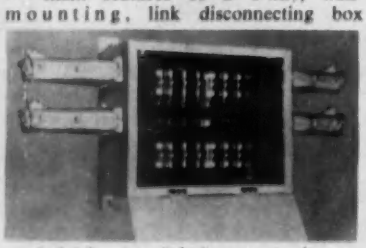
Copper clad "Delaron"

PRINTED circuits have now lost their novelty, and they are finding a considerable field of application in industrial light-current equipment. For standardised electronic control and test equipment they are eminently suitable, since with the correct choice of insulated laminate backing, multi-component assemblies can be readily made up. To this end, THOMAS DE LA RUE AND CO., LTD., Imperial Hse, Regent St, W.1, offer a series of "Delaron" plastic laminates with a copper foil bonded to one or both surfaces.

In each case, the copper sheet is 0·0015 in. thick and has a weight of 1 oz/sq ft, whilst the laminate is offered in sizes from 0·02 in. to 0·5 in. in sheets of 45 in. by 18 in. Of the three grades of laminate available, D.C.C. 40 is a paper base grade and is suitable for use where low electrical properties and high mechanical strength is required, but where very humid conditions are not likely to be encountered. Another grade is D.C.C. 20, stated to have good electrical, and machining properties, and under certain circumstances may be cold punched although the recommended punching temperature is 85° C. The third grade available, D.C.C. 30, is also paper based, and used for low tension applications. Having good machining and hot punching characteristics, it conforms to B.F.S.1137, Type III, whilst D.C.C. 20 conforms to Type I.

Enfield Link Disconnecting Box

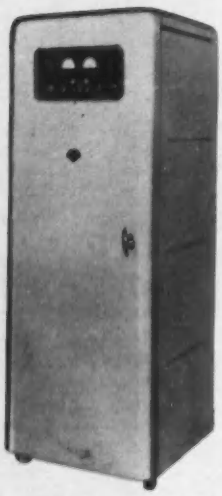
STRENGTH and accessibility are the main features of a 6-way, wall-mounting, link disconnecting box recently produced by ENFIELD CABLES LTD., Scuthampton Row, W.C.1. This new Enfield product has an extremely robust case being fabricated from sheet steel, a hinged lid enables quick access to the disconnecting links within the box. The interior of the unit contains 300 amp busbars and connection post, fitted with Costok links on 3½ in. centres. Sealing boxes provided on the left and right hand sides, and on the base, are suitable for use with 0·3 sq in. 4-core P.I.L.C. and A. low voltage cable.



Enfield's robust link disconnecting box

High Power Ultrasonic Generator

A POWER source for ultrasonic magnetostrictive transducers used for cleaning, degreasing, soldering and drilling, has been designed and produced by MULLARD LTD., Shaftesbury Ave, W.C.2. This generator has an output of 2 kW in the frequency range of 10 kc/s to 30 kc/s, and is driven by a variable R.F. oscillator followed by amplifier stages. In the power supply unit, h.t. for the push-pull output stage is derived from a bridge rectifier employing rare-

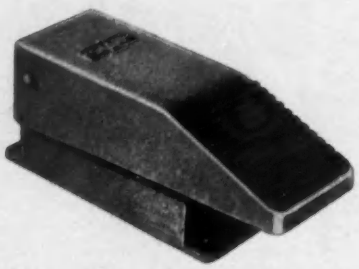


The Mullard 2 kW ultrasonic generator

gas valves, vacuum-type rectifiers are used for the other h.t. supplies and a variable low voltage d.c. polarising supply is obtained from a bridge circuit using metal rectifiers. A robust construction, automatic protection circuits and simple controls make this low frequency ultrasonic generator suitable for everyday industrial use.

Lightweight Foot Switch

AS a result of enquires from manufacturers requiring a foot operated switch of medium rating, SHARP CONTROL GEAR LTD., Ashby-de-la-Zouch, Leicestershire, have introduced a robust, light, dustproof foot switch. Known as the "Minifoot," the unit has been designed with emphasis on light operating pressure and light weight, making the switch suitable for female operatives. The pressure required to operate the switch is said to be only 2 lb and the angle of the tread plate has been experimentally determined



This new foot switch by Sharp is specially designed to minimise fatigue

to accommodate a shoe with almost any type of heel. This certainly supports the claim that the unit has been designed almost exclusively for the female operative. Four types of unit interiors incorporating the Sharp micro snap-action contactor are available for different switching requirements and the mechanisms may be interchanged without modification to the standard case. These interchangeable interiors enable the usual switch operations to be varied as the occasion demands and the switches are rated at either 15 amp 500 V a.c. or 10 amp 24 V d.c.

Counting with Precision

COUNTING instruments are so commonplace in modern industry that it is sometimes easy to overlook both the accuracy and variety of units which may be obtained. Yet the importance to the electrical industry of both precise counting, whether it be of length of wire, number of revolutions, or quantity of articles and, the suitability of a given counter to meet specific requirements, cannot be overestimated. An indication of the diversity of counters available, and the accuracy attained is provided in the range of "Albion" ratchet and revolution counting instruments offered by B. AND F. CARTER AND CO., LTD., Albion Works, Bolton, Lancs, and described in their leaflet No. 18/7.

In transformer winding, as one example of a specific application, it may be necessary not only to count turns but also to stop the winder and give a signal when a given figure is reached. For such purposes, a particularly suitable instrument is the type 28-1. It is of the predetermined type, being set initially to the figure required and then counting backwards to zero, when a microswitch will either make or break contact. To prevent unauthorised resetting of counters, other units, such as the type 1-2, are supplied with "Yale" key reset.

Many instances, however, require the counting indication to be made remotely and for this purpose they offer type 29B-1, an electro-magnetic unit operated by electrical impulses originated at a switching mechanism on the machine itself. Suitable for usual voltages, it is a five figure counter so geared that one unit is recorded for every impulse received, and counting at up to 150 strokes per minute.

Apart from the range offered, the firm also caters for individual requirements.

Latest Solus Hairdryer

MODEL 54, the latest model hairdryer now available from ELECTROTHERMAL ENGINEERING LTD., 270 Neville Rd, E.7, is an attractive well-designed model selling at 66s. 3d., tax paid, with a covering 12 months guarantee.

In shock-proof ivory colour plastic casing and weighing 1¼ lb the Solus 54 provides hot or cold air by means of two switches in the handle easily operated. An extra feature is the useful and practical stand supplied without extra charge. Made in two voltage ranges 200/220 V and 230/250 V, a.c. only the Solus 54 is loaded at 400 W.

The Solus 54 is an attractive and practical hairdryer

"Hostess" Infra-Red Grilling

CLAIMED as the first domestic infra red contact grill the Tel "Hostess" by BRATTEL ELECTRIC LTD., 142 Southampton Row, London, W.C.1, cooks a steak in 60 seconds, chops and fish fillets in 90 secs., toast and kidneys in 40 secs. Well done sausages take a bit longer at 150 secs. With the exterior finished in lasting highly polished aluminium easy to clean and attractive and measuring 9 in. × 8 in. × 6 in. with hotplate area 87 sq in. the Tel "Hostess" is loaded at 750 W. Selling features are the saving of electricity and fat, no loss of food weight, improved taste of food retaining juices and natural flavours, no fumes and the saving of time, for the Hostess grill cooks both sides at once. It is due on the market next month.

Now the Remington "Super 60"

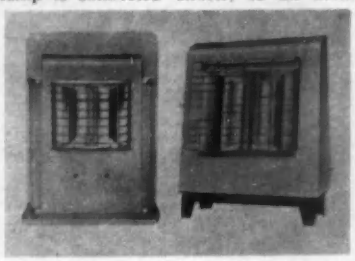
TO MAKE its public debut on Sept. 1 as their first line electric shaver is Remington's "Super 60," an advanced design model incorporating a number of improved features to smooth the path of shaving. Marketed by REMINGTON RAND LTD., Shaver Division, 26-40 Kensington High St, W.8, the "Super 60" features a new design of face-fitting head with spring-loaded cutters to give closer and faster shaving whilst four rows of surgical steel cutters, with 1,008 diamond-honed cutting edges are claimed to afford the largest shaving area yet. Power unit is a double-insulated universal 9,500 r.p.m. motor, suppressed against radio and TV interference.

The new shaver is available in two models—the "regular" version for 210-240 V a.c./d.c., selling at £8. 6s. plus £1. 11s. 11d. p.t. and the "triple volt" version, for 110-130 V, 140-160 V, and 190-240 V, a.c./d.c., selling at £9. 3s. plus £1. 14s. 11d. p.t. Concurrently with the introduction of the "Super 60" comes a reduction in price of the "60" model—the "regular" version down to £7. 2s. 4d. plus £1. 7s. 8d. p.t. and the "dual volt" version down to £7. 19s. 4d. plus £1. 10s.-8d. p.t. These reductions take immediate effect, and to compensate retailers having stocks of "60" models at the original invoice price, orders for "Super 60" shavers, up to Sept. 12, 1955, on a "one-for-one" basis, will be accepted at the specially reduced terms of £4. 18s. 11d. (plus £1. 11s. 11d. p.t.) for the "regular" and £5. 11s. 3d. (plus £1. 14s. 11d. p.t.) for the triple volt versions.

From the same date, easy terms will apply only to "Super 60" models and the "60 Auto-Home" shavers, as will the £2. trade-in allowance on old electric shavers.

Additions to G.E.C. "Cosyglo" Range of Fires

TELEVISION is making the fireside once more the centre of family life, and the latest addition to the "Cosyglo" range of fires made by THE GENERAL ELECTRIC CO. LTD., Magnet Hse, Kingsway, W.C.2, has been designed with this in mind. Available in September, the new "Cosyglo" 2,000 W screen fire which completely covers the majority of fire-openings, has glass side panels illuminated by a 60 W amber sprayed Osram lamp fixed at the base of the fire. The lamp is connected directly to the main



The two new "Cosyglo" models. The TV model is on the left

terminals and can be used independently of the heating elements, which are controlled by two separate switches. The illumination of the side panels not only transforms the unit into an attractive fire-screen but at the same time provides a useful light for use when viewing television.

Finished in hammered bronze and having dimensions of 27½ in. high x 21 in. wide with a depth of 8¼ in., it can be used either in a fireplace or as a portable—a projection at the rear of its base provides the necessary stability. This can be removed if the fire is to be stood against a flat surface. Price of the fire, catalogue number D2814, is £11. 10s. plus £4. 4s. 1d. purchase tax.

For those who require a fire of contemporary design there is a new G.E.C. "Cosyglo" 2,000 W portable reflector also available in Sept. Its dimensions are: height 19¼ in., width 17½ in., and depth 7 in. This model is compact and easy to carry from one room to another, and available either in "silver bronze" or green with a black base. Price of the fire, catalogue number D2813, is £5. 15s. plus £2. 2s. 1d. purchase tax.

For the Electrical Trade

"Sesame" Opens the Door

CAR owners will particularly appreciate the value of electrical remote control of garage doors which saves them the need for leaving the car when garaging it, especially in bad weather. Under the appropriate name of "Sesame," ANDREW WISE LTD., 9 Alexandra Rd, Leigh-on-Sea, Essex, now offer a door-opening unit which is arranged to be controlled from a push-button station in the drive-in by the driver when sitting in the driving seat.

Designed for use in garages having hinged double doors, it is constructed to enable it to be owner-fitted. The unit itself comprises a guide, fitted to the roof support, and in which a block slides forwards and backwards. Hinged to the block are two stays, one fitted to each door. A lamp is incorporated in the unit to illuminate the garage and drive-in when the doors are fully opened. An automatic clutch ensures that the doors cease to continue to open should they be temporarily obstructed, a cut-out stopping the motor if the obstruction persists for more than a few minutes.

Uniform Lighting for Offices

NOW available in this country is the "Luve-Tile" system of illuminated ceiling, a form of louvring extending over the whole of the ceiling to give uniform distribution of lighting. Previously developed and marketed in America and Canada, it can be obtained in this country through HARRIS AND SHELDON (ELECTRICAL) LTD., 31 Stafford St, Birmingham 4. Moulded in polystyrene, "Luve-Tile" is supplied in a standard unit or tile 12 in. × 12 in. × 2¼ in. deep divided into approximately 2¼ in. sq cells, found to be the optimum size for appearance, light output and diffusion. These, together with two other components—joint clips and hanger assemblies—comprise all that is required in appropriate quantities, to install a complete ceiling. Assembly is straightforward, tiles being clipped together with joint clips which snap into specially moulded recesses near the corner of each tile.

NEWS OF THE WEEK

Plans Complete for Copenhagen Fair

NUMBER OF ELECTRICAL FIRMS BELOW BAGHDAD TOTAL

PREPARATIONS for the second British Overseas Trade Fair, due to be opened in Copenhagen on 29 September, are now well advanced, and all is set for one of the best displays of U.K. equipment and manufactured products ever staged outside this country. The exhibition promises to be the largest devoted to British goods to be held in Europe. Shorter distance and lower freightage costs have contributed towards even better results than were achieved at Baghdad last year. A total of some 600 exhibitors will be taking part at Copenhagen compared with about 400 at Baghdad. Nature of the displays will also be different. At Baghdad the accent was on capital goods whereas the Copenhagen Fair will be mainly concerned with smaller and domestic commodities. Direct mail and other advertising on the Continent has brought good response, and Scandinavians are showing keen interest. Unfortunately, the number of exhibitors in the electrical and allied industries is slightly down on Baghdad—the total so far being just below 50.

Special plans have been laid in Copenhagen as regards attractions other than actual exhibits. Most elaborate arrangements have been made for the Military Tattoo, with the General Electric Co. providing colourful displays of floodlighting at Rosenborg Castle. Main illumination will be of red neon floodlights, supplemented by white light in sodium units. Seven groups of lamps, each comprising one red and two orange units, are ranged along the main frontage.

I.P. CABLE INSTALLATION IN SOUTH AFRICA

WHAT is believed to be the first impregnated pressure cable installed in Africa has recently been put into service. It was laid between Salt River power station and Oakdale substation (about 12 miles) as part of the Electricity Supply Commission of S. Africa's Cape Western system. The cable, operating at 66 kV, is the first of two feeders linking the power station with the substation, and the second, laid at the same time, is expected to be in commission soon. Cables are 3-core, mainly with conductors of 0·35 sq in., although on some sections these have been increased to 0·5 sq in. They will carry about 90 MVA.

Made by British Insulated Callender's Cables Ltd., the cables were laid by the Commission, who employed B.I.C. Construction in an advisory capacity. The contract also included an additional 33 kV solid-type feeder laid between Salt River and Elsie's River substation, about seven miles away.

URANIUM FOR INDUSTRY

SPEAKING in Geneva last Tuesday afternoon, Sir Christopher Hinton, of the U.K. Atomic Energy Authority Industrial Group, stated that natural uranium would be made available for any power reactors sold abroad by British industrial firms in the 1960s. The terms, sale or lease, on which the uranium would be supplied would have to be discussed in each individual case. It is understood that supplies of enriched uranium for reactors are not precluded automatically by this statement.

New Wage Claim to be made by Engineering Unions

A CLAIM for a substantial increase in pay for engineering and shipbuilding workers is likely to be made in the next month or two following the annual conference of the Confederation of Shipbuilding and Engineering Unions at Blackpool. An executive meeting of the union's leaders is taking place today, and details of the claim are expected to be decided then. Such a claim is almost certain to cater mainly for increases for craftsmen. Popular forecast is a demand for a 10% increase, which would mean an extra 15s. 6d. a week for craftsmen.

150 Overseas Scholarships a Year is F.B.I. Aim

THE Overseas Scholarships Scheme, inaugurated by the F.B.I. in 1950 continues to expand rapidly. In the five years which have elapsed 80 scholarships have been awarded, 64 students have actually arrived in this country, and of that number 23 have completed their training and returned home. These facts are contained in the annual report of the scheme up to the end of last March, which was published last Friday. Since March six more students have arrived in the U.K. and 44 more are expected before the end of the year. A total of 107 scholarships are now being offered for award in 1956, but it is hoped that within a short time it will be possible to award 150 each year.

Up to March, scholars had come from a dozen countries, but since then scholarships have also been awarded in five other countries, and are being offered in a number of others also. Main objective is of course a long-term investment in our future exports. This is achieved by technical assistance, especially to underdeveloped lands, and by familiarising leaders of industry in foreign parts with our equipment, thereby influencing them to "buy British." The report includes a list of 73 firms and organisations already participating in the scheme, of which a good proportion are electrical. Sir Arthur Fleming, chairman of the F.B.I. Overseas Scholarships Committee, urges all engineering organisations, large or small, public or private, manufacturing, consulting or contracting, to support the scheme for their own and the country's good.

A new type of scholarship announced in the report is that for university professors in Latin America. It will cover a period of 20 months in Britain.

Gas control kiosk and seating ends for 66 kV impregnated pressure cable at Oakdale distribution station in S. Africa's Cape Western supply system

Smoke Control

THE Scottish burgh of Paisley is imposing conditions on tenants of all their future council houses to control smoke emission. The tenants will be required to sign an agreement to burn only approved smokeless fuels, we understand, although they will be relieved of the obligation if at any time supplies of the appropriate fuels fail. Indications are that arrangements to date have involved only the solid fuel suppliers. No specific area has been designated as yet for this experiment, but it is expected that the Foxbar scheme and a central redevelopment scheme will be those concerned. If this is so, it will cover about 4,000 houses

BOOM IN DOMESTIC APPLIANCE SALES HAS DECLINED

A MARKED decline in the output of electric cookers and immersion heaters in the past few months is reported in a recent issue of the *Financial Times* assessing current trends in domestic appliance sales. This time last year the electrical appliance industry was enjoying a boom. So far this year sales of most appliances have been slightly above those of the first half of 1954 although well below those of the second half, which would appear to indicate the effect the removal of hire purchase restrictions had. Cookers and water heaters are exceptions to the general trend. The fall in cooker output has been about 20%. The 92,500 cookers produced in the second quarter was some 10% less than in the Jan.-Mar. quarter and the Apr.-June quarter of 1954. Manufacturers of immersion heaters have also put the brake on since the heavy output of late 1954 and early 1955.

In contrast, output of electric storage water heaters for domestic purposes is expanding, and the upward trend started at the beginning of last year continues. A new quarterly record of 49,600 was recorded in the second quarter of this year, which figure was some 40% higher than that for the first quarter and 75% above that of the corresponding quarter of 1954.

In the case of gas appliances, we note that sales continue to run well below the level of a year ago. It is reported that some manufacturers have not only cut production but also laid off staff. Cooker sales are stated to have fallen by 20%, and the July figures by as much as 40%. Sales of gas water heaters and washing machines are some 30% lower. Output of water heaters has been reduced, and the 84,700 heaters made in the second quarter of this year is 24% less than in both the previous quarter and the same period last year. It is significant that between the first and second quarters of 1954 manufacturers stepped up production by 17%.

Not an export order this time, but a consignment of distribution transformers for the South of England. The 100 kVA, 200 kVA, 500 kVA and 750 kVA transformers are leaving Ferranti's factory at Hollinwood, Lancs. All the units have cores which have been made from cold rolled electrical steel

Group of Companies announce New Names

CHANGES in names are to be made within the Heenan and Froude organisation, it is announced. Name of the parent company in the group is to be altered from Heenan and Froude Ltd. to Heenan Group Ltd. It is intended that Heenan Group Ltd. will be the holding company, while Heenan and Froude Ltd. will be re-registered as a subsidiary entirely devoted to manufacturing activities. Products of the group range from jet engine test plant and automatic machines to locomotives and refuse disposal equipment. An extraordinary meeting to give effect to these decisions is to be held at Worcester on 29 Aug.

Other companies in the organisation are Fielding and Platt Ltd., W. G. Bagnall Ltd., Morton Machine Co., Ltd., and Industrial Waste Eliminators Ltd.

OFFICIAL PUBLICATIONS

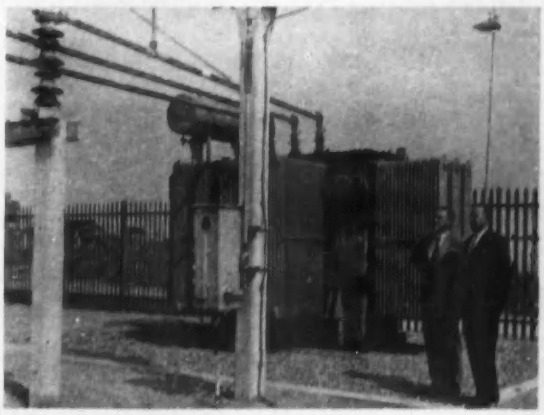
MINES. Report of H.M. Inspector of Mines for 1954. N. Eastern Div. H.M.S.O. 2s.

Cable Testing

WE wish to point out that, in our article on page 124 of our 28 July issue describing the fatigue testing of cable, the equipment illustrated should have been described as capable of operating at up to 9 cycles/minute and not as stated.

Mutisarrif of Baghdad visits Eastern Board

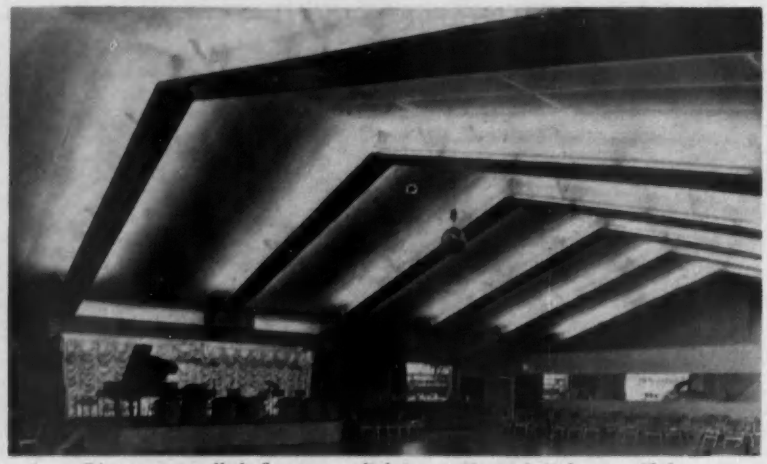
ALTHOUGH primarily concerned with local administration while on a visit to this country, the Governor of Baghdad, H.E. Abdul Jabbar Fahmy, took the opportunity of studying some aspects of rural electrification. Consequently he spent a day visiting electrical installations in the Norwich district of the Eastern Electricity Board. He was shown round by the Norwich district manager, Mr R. E. Atkins. The Governor inspected a major 33,000 V substation at Wroxham where he also saw a rural electricity service centre with offices and stores. The visit also included a canning factory in North Walsham and a fully-electrified farm at Woodbastwick where electricity is being used for a wide variety of farming purposes.



H.E. the Governor of Baghdad with Mr R. E. Atkins (left) inspecting the 33 kV substation at Wroxham, during his visit to the Eastern Board

Halifax repudiates Liability for £34,500 Claim

AT their Aug. meeting Halifax Town Council repudiated liability for the payment of £34,500 said to be due to the C.E.A. as part of the assets of the Corporation's former electricity supply undertaking. The decision was taken on a recommendation of the finance committee, who also authorised the briefing of counsel in any proceedings which might be started against the council. A subcommittee was formed to deal with any matters arising on the C.E.A.'s claim, and also to deal with the disposal of nearly £11,700 tax refunded in respect of costs and expenses incurred by the Corporation in connection with the former supply undertaking.



Dimmer-controlled fluorescent lighting at Norwich Industries Club

Large Dimmer-Controlled Lighting Installation

ONE of the largest dimmer-controlled fluorescent colour-change lighting schemes in this country has been installed at Norwich Industries Club by Thorn Electrical Industries Ltd. Over 300 tubes in gold, blue and pink are controlled by an electronic dimmer bank using 21 pairs of thyratron valves. Fibrous plaster lighting troughs, each housing three continuous runs of six 5 ft 80 W tubes on either side are suspended from the portal frames of the building.

Each of the colour groups can be controlled independently by hand until automatic control is required. There are two control panels, one in the bandstand and one on the balcony, each having the three colour controls and a 5-position switch, giving a variety of tones and intensities of illumination. Control can, of course, be switched from one panel to the other. The bandstand includes local lighting from incandescent fittings and a coloured background which can be controlled in unison with or independently of the main hall. Architects for the hall were J. Owen Bond and Sons of Norwich, and electrical contractors for the lighting scheme were the local firm of Messrs G. S. Carey.

Advance Components to move to Hainault

NEARING completion on the Hainault industrial estate is the new £60,000 factory of Advance Components Ltd. Plans for their new 22,000 sq ft factory have been in hand for almost a year but the works is nearly finished and the move from Back Lane, Walthamstow, is expected to take place early in the New Year. Advance Works in Back Lane will be sold. The firm took over these premises in 1936 just after they had been built.

DUNDEE TRAMS MAKE PROFIT

DUNDEE Corporation Transport Department, reporting on operations during 1954-55, revealed that while their tramways were making a profit of £14,629, their buses lost £17,540. The trams' profit was stated to have resulted mainly from the restriction of expenditure on permanent way renewals; the result of substituting buses for an experiment period on one route. £21,000 was cut from expenditure but there were £6,000 wage awards. Bus operation costs went up by £13,000.

Electrical Equipment for Kenya Substation

A CONTRACT for the supply of electrical equipment for the Juja Rd substation in Kenya has been secured by the British Thomson-Houston Co., Ltd. The substation was specially designed in conjunction with the same company's hydro-electric plant for the Uganda Electricity Board's Owen Falls power station. It will transmit 40 MW of power to Nairobi, over the Board's 132 kV system to Torara and thence by the Kenya Power Company's twin-circuit 132 kV line to Nairobi—a distance of 330 miles. Design of the plant at the Nairobi receiving end will allow for the possibility of the line from Tororo being tapped to provide a supply to the Eldoret-Kisumu area and Nakuru.

Juja Rd is being designed by Balfour Beatty and Co., Ltd., and the B.T.H. are to supply the 132 kV and 66 kV oil circuit-breakers with associated control and protective equipment, synchronous condensers, transformers, and switchgear. The 66 kV switching station at Juja Rd will become the focal point of the local system. Provision is being made to allow for extensions as and when Kenya's power resources are developed.

Silicones for Industry

AN exhibition under the above title, on the history, production and application of silicones is to be staged at Leeds Church Inst., 5 Albion Place, Leeds, between 26 and 30 Sept. Invitations may be obtained on application to the sponsors, Midland Silicones Ltd., 19 Upper Brook St, London, W.1. The exhibition will be open daily from 10 a.m. to 6 p.m. (except Mon. 2.30 p.m. to 6 p.m.). It includes numerous working exhibits and film shows will be given daily at intervals.

AUTUMN AND SPRING WELDING MEETINGS

ARRANGEMENTS have been made for a number of Inst. of Welding meetings. The autumn meeting is to take place in London between 2 and 4 Nov. It will include the annual dinner and presidential address, and four technical sessions on aspects of inert-gas-arc welding processes. Principal guest at dinner will be Mr F. J. Erroll, Parliamentary Secretary, Ministry of Supply, and Sir Edward Boyle, Economic Secretary to the Treasury, will also be present.

Other dates fixed include those for the Institute's spring meeting next year, which will be in the Eastern Counties from 3 to 5 May. A conference on the Function and Education of Welding Engineers, is being convened by the Institute and will be held in Sept. 1956.

Productivity with Welding

IN addition to the above, we hear that the British Welding Research Association are arranging a number of meetings on Increasing Productivity by the Use of Welding. These will be held at various centres throughout the U.K., and the first will be in Glasgow on 20 and 21 Sept. Venue is the Institution of Engineers and Shipbuilders in Elmbank Crescent. There will be four lectures each day. Admission is by ticket, which can be obtained from the Organiser, Welding Productivity, 8 Northumberland St, Edinburgh.

The First Half-Century

It is curious how closely Colonial electrical undertakings resemble, in administration and in records, those at home. I have before me the last annual report and accounts of the municipal electricity dept. of Melbourne. Save for one item, the whole document is as like its British equivalent as two peas. There has been the usual discussion as to the disposal of the surplus of £9,000 odd. Ultimately £6,000 goes to repay "change over" expenditure, £2,000 goes to swell depreciation account, and £1,000 is contributed in relief of rates. This is precisely what would have happened in Lancashire. "Flame" arc lamps have caught on, and the motor load has almost doubled, thanks partly to the popularity of electric lifts, and to the adoption of electric driving by a couple of big newspapers. Prices for both public and private supply are to be reduced; and the maximum demand system has been adopted with excellent results. But thereby hangs a tale, and this is where British experience supplies no counterpart.—*From our issue of* 17 *Aug.*, 1905.

Lighting Course at Borough Polytechnic

A COURSE on illuminating engineering is being arranged by the Dept. of Electrical Engineering of the Borough Polytechnic. Starting next month it will include experimental work in a recently equipped illumination laboratory. Classes are to be held on either two evenings a week or on one evening and one afternoon, leading at the end of the first year to the City and Guilds Intermediate Exam. in Illuminating Engineering. A further year's study will enable the students to take the Final City and Guilds Exam. Enrolments take place during the week beginning 19 Sept., and details may be obtained from the Polytechnic Secretary, Borough Rd, London, S.E.1.

L.C.C. switches Another Floodlight on Education

ONCE again the opportunities afforded to Londoners in the field of education during the coming winter have been summarised in the L.C.C.'s latest edition of *Floodlight*. More than 500 subjects have been listed, from accountancy to zoology, representing the many and varied courses being run at the numerous colleges and schools. Electrical engineering has, of course, received plenty of attention and there are again courses available on all its aspects. Other subjects include Heating and Ventilation, Illuminating Engineering, Power System Protection, Refrigeration, Telecommunications, Radio and TV. All subjects are in alphabetical order, together with a comprehensive list of Polytechnics, Colleges and Institutes. This year enrolment week begins on 19 Sept. *Floodlight* costs 6d. (or 8d. by post).

Matling Ltd's new Saturn II in action on a factory floor

Locos in 29 Countries

AN illustrated brochure describing many of the electric and diesel-electric locomotives and trains supplied to all parts of the world has been produced by their makers, the English-Electric Co., Ltd. In over forty pages is contained photographs of locomotives and details about each which cannot fail to impress. To date the company's traction equipment is operating in, or is on order from, a total of 29 countries. "English Electric Traction 1955" points out that rolling stock apart, the company has carried out complete railway electrification schemes in eight countries besides Great Britain. This a well-produced brochure which will almost certainly impress would-be purchasers as well as the casual reader.

New Machine will scrub your Factory Floor

A MOBILE scrubbing and drying machine produced particularly for the cleaning of factory floors has been introduced by the Cowlard Floor Maintenance Machine Div. of Matling Ltd., Wolverhampton. The machine performs two functions simultaneously. It scrubs away the dirt and then lifts it from the floor. It consists fundamentally of a strong light alloy base casting which contains the traction unit and on which the other components are mounted. Equipment is powered by a 24 V Exide-Ironclad traction battery consisting of 12 MVU11D cells and with a capacity of 175 Ah. The Matling traction unit is driven by a constant speed 24 V motor. Brushes have been arranged in an inter-meshing pattern and are easily interchangeable.

As to actual method of operation the detergent and water mixture is gravity fed through a sprinkler system immediately ahead of the rotating brushes. As the machine passes over the scrubbed area of the floor, the dirty water is piled up by trailing squeegee rubbers and sucked up into the sludge receiving tank. The cleaned floor is dry within seconds.

Approval of Lawn Mowers and l.v. Transformers required in Victoria

STATE Electricity Commission of Victoria (Australia) have announced that electric lawn mowers up to 1 h.p. and extra-low voltage transformers of the kind used for toys, bells and portable drills, have been added to the list of electrical appliances which must be submitted to the Electrical Approvals Board. Manufacturers, importers, and others concerned with lawn mowers will have to obtain approval of products marketed in Victoria after 1 July, 1956, and for those concerned with the transformers the date is 1 Feb. next. The Commission has pointed out that if submission for approval was postponed too long, delay in obtaining approval was almost certain.

E.T.U. report on their Finances in 1954

EXPENDITURE by the Electrical Trades Union exceeded income by £293,651 it is stated in the annual report for 1954 circulated last week. Expenditure amounted to £730,394 and income to £436,743. As a result general funds fell to £353,169 by the end of the year. One of the heaviest individual items of expenditure is recorded under the heading of "dispute pay," and this totalled £190,645. Other items of outgoings were £407,886 working expenses, £28,653 affiliation fees, etc., and education expenses of £28,282. Salaries and allowances to officials at headquarters amounted to £29,732 and at district offices and branches to £129,151. Main source of income was contributions from members to the general fund, this amounted to £351,524.

NEWS IN BRIEF

Tenth national conference of the British Inst. of Management will be held this year at Harrogate from 2 to 4 Nov. Theme will be the Impact of Science on Management in the Future.

Members of Reading branch of E.A.W. saw a demonstration of wine making at a recent meeting.

According to the report of Lewes Highways, Works and Town Planning Committee a sub-committee is to meet to consider the whole question of street lighting in the town.

Number of TV licences increased by 52,505 in June. At the end of the month 14,035,547 broadcast receiving licences, including 4,676,422 for TV and 275,910 for car radios, were current in the U.K. Comparable figures at the same time last year were 13,512,275, 3,411,046 and 236,057.

Herbert Robinson Ltd., the Cambridge firm of electrical engineers, opened a new store in the Butter Market, Ipswich, last week.

Whole of the penny entrance fees in the *Evening News* competition at the 1955 Radio Show is being donated to the E.I.B.A.

Further contract for pumpless steel-tank rectifiers for the Netherlands Railways has been awarded to the G.E.C. Latest order covers nine 1,224 kW 1,500 V twin-cylinder units fitted with electronic arc suppression equipment.

A cricket bat and tennis racquet have been presented by the Electrical Trades' Commercial Travellers' Association to the boy and girl at the Royal Commercial Travellers Schools for the most outstanding records in the season. These are annual gifts.

Two new publications have been issued by the British Welding Research Association. They are "The Plastic Moduli of British Standard Rolled Steel Joists" (ref.: T.31) at 2s. 6d.; and "The Spot Welding of Aluminium and Its Alloys" (ref.: T.8A) at 5s.

Complaints about the disgraceful state of land surrounding many substations owned by the N.W. Electricity Board, were voiced at Chadderton Council meeting.

ELECTRIC SUPPLY NEWS

Ayr

A scheme for the reinforcement of supplies to the southern part of Ayr has been approved by the S. of Scotland Electricity Board. Seven substations are to be changed over from 3·3 kV to 11 kV working and existing switchgear arrangements at two other substations will be modified. The work also includes the laying of 3,575 yd of h.v. cable and 250 yd of l.v. cable. Cost of the scheme will be about £26,600 and the project forms a continuation of the reinforcement scheme in Ayr, which has been in progress now for some time.

Banffshire

A ceremony at Inchtamak Farm on the outskirts of Cornhill, marked the first step in the comprehensive electrification scheme for Banffshire. The N. of Scotland Hydro-Electric Board has now brought electricity to Cornhill and four neighbouring districts for the first time. A supply has been taken to 187 premises, including 56 farms, 44 crofts and 87 domestic and other premises. The switch-on was performed by Mr W. S. Duthie, M.P. for Banffshire. At the ceremony, Sir Hugh McKenzie, deputy chairman of the Board, said that on nationalisation, 7% of the farms and only 1% or 2% of the crofts were connected. Now they had reached an average of about 45%. At present the Board were connecting 101 farms and 76 crofts per month.

Dorset

Allegations that Dorset was becoming nothing short of a network of electricity pylons, posts and wires, were made by Col J. D. Belgrave, secretary of the country branch of the C.P.R.E., in his annual report. He was referring particularly to the Southern Board's proposal to erect new power lines from Poole to Yeovil and Shaftesbury. The secretary stated that after meeting representatives of the Board and Planning Authority he had been struck by the care and skill shown by surveyors in selecting sites so as to keep them concealed as much as possible, but he had also been struck by the great number of posts and wires which had already been erected. Col Belgrave suggested that in spite of the necessity for pylons part of the way, and the increased cost, both lines from Poole should be taken as far as Pulham and thence on poles to Yeovil and on poles over low ground north of Sturminster Newton to the northern outskirts of Shaftesbury. A decision was awaited from the Planning Authority.

Northumberland

Opposition to the Blythe Generating Station (Ancillary Powers) Bill, promoted by the C.E.A. is to be continued by Northumberland County Council. The C.E.A. propose to dispose of waste ash from the new Blyth power station by sluicing it into the sea by pipeline at Cambois. The Council maintain that the ash should be taken out to sea by barges. It is feared that waste from the pipeline will interfere with inshore fishing as well as being washed back on to the beaches.

Somerset

A £22,000 electrification scheme to take a supply to the Kilmersdon area was started earlier this month by the S. Western Electricity Board. The project is said to be one of the largest undertaken by the Board, and will include Stratton-on-the-Fosse, Babington, Mells, Holcombe, Leigh-on-Mendip and Norton-Radstock, besides Kilmersdon. It is hoped to complete it in the New Year. Mr R. W. Steel, Bath district manager, said that the occupiers of 17 farms and 118 other properties within the boundaries of the scheme, had agreed to take a supply.

Conisbrough

The U.D.C. have given their consent to the Yorkshire Electricity Board's application to erect overhead lines and lay underground cables at Denaby Main. The Board is proposing to take additional supplies to Denaby and Cadeby Collieries in accordance with planning permission already obtained.

Tyrone

Complaints that the proposed hydro-electric scheme on the Rivers Mourne and Derg would do tremendous harm to farms have been made to the County Council by a deputation of farmers. The farmers maintain that 600 acres of the best land would be lost; Ardstaw village would be wiped out; and losses to the district would outweigh advantages. Mr M. O'Neill said that while he sympathised with farmers, it was essential for the country to have cheap electricity. It was agreed that members of the council inspect the affected areas and hold a special meeting to deal with the matter.

On the other hand, Strabane U.D.C. have welcomed the proposed River Mourne scheme. The council decided at a recent meeting to join the local Unemployed Association in welcoming the scheme. A letter from the Association asked the council's support in view of the fact that its implementation would be of great advantage to the community. It was estimated that in addition to saving £100,000 annually, an additional 47,000 tons of coal would be saved each year. A scheme for improvements to the Strabane bridge over the River Mourne was being prepared for submission to the Ministry of Commerce, the council was told. The Ministry is being asked to reconsider the request for a new bridge.

Yorkshire

An electricity supply to the Fewston and Blubberhouses area of the Washburn Valley may be available by Oct., it has been stated. After poles for the overhead lines had been erected last winter there was a hold-up in the scheme because a proposed Admiralty radar station necessitated the laying of part of the line underground. The radar station is to be built near Blubberhouses. The Yorkshire Electricity Board have now received final clearance from the Ministry of Fuel and Power, and they hope to have the supply available in two months.

Sayings OF THE WEEK

"Nuclear will seldom be a competitor to hydro-electric power, and in countries like Scotland these sources should be developed side by side." . . . MR J. M. KAY, of Kennedy and Donkin. *"Hydro-electric schemes are antiquated in the light of nuclear power developments, and served only to use up good farm land."* . . . Quote from the *Farmers' Journal*, organ of Ulster Farmers Union.

"I am confident that in five to ten years from now, ships will be operating with atomic power." . . . MR SIGVALD BERGESEN, JNR., prominent Norwegian shipowner and shipbuilder.

"By placing one kilowatt of electrical energy at the disposal of the worker we increase his potential capacity for manual work by about ten times." . . . from a *Western Morning News* report of Industries of Plymouth Exhibition.

LIGHTING SCHEMES

Ashton (Lancs). £6,000 to be spent on street lighting scheme in Oldham Rd and Cavendish St.

Battersea. Modernising borough's street lights is to cost £10,650. High pressure mercury vapour lighting will be used and concrete columns erected in Queenstown Rd, Lavender Hill and St. John's Hill.

Dewsbury. Street lamps on main roads and bus routes are to be converted to sodium lighting at a cost of £10,792.

Keynsham. £18,000 scheme for street lighting improvements has been approved.

Leicester. It is proposed to convert gas street lighting to electricity over a period of ten years at a cost of £100,000.

Newcastle-on-Tyne. First stage in ten-year scheme for conversion of 10,000 street lamps from gas to electricity is estimated to cost £37,765. Chief areas affected in first year's programme are St. Anthony's and Greystones estate, Newton Park, Walkerville and Benwell.

Newhaven. Ministry approval received for £3,573 street lighting scheme in main street.

Stockton-on-Tees. T.C. has received loan sanction for £12,420 for street lighting in the Haverton Hill Rd area.

Westminster. £31,800 to be spent on fluorescent lighting in ten city streets.

COMPANY ACTIVITIES

I THINK it would be a good plan if the Central Electricity Authority worked on similar lines to the Board of Trade with its preliminary trade figures, and public companies with their preliminary profit figures. The full accounts of C.E.A. are not due until September but obviously the figures are known and could be published and added to the National statistical information which is so badly lacking.

The figures are out but have to be dug out from small type in the prospectus of the Authority's £200m loan which was quite a success last week. These figures reveal that Britain's electricity system has had its best year so far; that the consolidated net surplus for the year to March 31 last was £18·8m as against £13·2m; that sales of electricity jumped nearly 12% to 62,411m units; while total electricity revenue also rose nearly 12% to £356·3m.

Another £500,000 increase in the number of consumers brought the figures to a peak 14·9m which is actually 1m new customers in two years.

Cable and Wireless Ltd., one of our industry's big customers raises the signal of distress in its accounts for the year to 31 Mar. last. Consolidated profits are down £236,218 to £1,828,220. Dividend, however, is maintained at 4%.

Messages, wayleaves and telephone receipts show a small reduction, reflecting a fall in telegraph and radio telephone traffic. Working expenses at stations increased by £191,104. Cable maintenance was more costly. Practically the same mileage of cable was expended but the cost averaged £50 a nautical mile more than the previous year owing to a greater use of heavier types.

The drive to promote efficiency and economy, state the board, has continued and will not be relaxed. Cumulative savings over the last five years are now running at approximately £250,000 per annum.

"This saving," they say, "is substantial, but is little more than the increase of staff costs last year.

"Under the inflationary conditions in so many parts of the world it is to be feared that running costs will go on rising and that they cannot be matched by a corresponding rise in revenue at present tariffs, despite steps taken to stimulate traffic."

In addition, the company is faced with the problem of financing renewals of the cable system. It has been able to build up reserves out of profits towards cost of replacing cable ships and shore installations but has not had a large enough profit margin to do the same in respect of the cable system.

"It is evident," states the report, "that if operating costs rise further, and given the necessity to renew the cable system at current prices, the company will be unable to renew the cable system at its present moderate profit level unless revenue can be increased."

All of which mounts up in my mind to the prospect of either (*a*) higher charges; or (*b*) some economies in purchases of cables and other materials—*From our City Correspondent.*

Cable and Wireless

Group revenue for year to 31 Mar. 1955 is £11,788,515 (*£11,803,611*) and group assets are £46·65m as compared with £45·39m, whilst parent assets of £45·35m compare with £44·42m.

Receipts from messages, wayleaves and telephones total £11,626,605 (*£11,656,831*) from which is taken payment to governments for taxes of £600,687 (*£618,029*). Sundry income is £358,682 (*£337,352*) and revenue from investments in gilt edged securities, etc., totals £403,915 (*£427,457*). Working expenses, cable maintenance costs and deferred repairs, however, total £7,204,082 against £7,034,677.

After deduction of admin. costs cables and landline rent, pensions, depreciation, renewals, etc., there is a net profit of £1,828,220 (*£2,064,438*). Tax provisions take £942,372 (*£966,729*). Capital reserve for relief on investment allowances is £153,674 (*nil*) and dividend cost £690,000 (*£660,000*) leaving carry forward of £750,936 (*£708,762*).

John E. Dallas

Results for the year ended 31 Mar., 1955, show Current Assets £439,684 (*£435,265*) including stock £232,186 (*£208,462*) debtors £186,486 (*£183,285*) and cash £2,411 (*£25,546*). Current liabilities £180,229 (*£180,146*) including bank overdraft £20,883 (*£38,747*).

London Electric and General Trust

Final dividend of 9% is recommended for the year to 30 June, 1955, on the £480,000 Ordinary stock as doubled by "rights" issue at par last December against the forecast 7% final dividend.

An interim of 4% has been paid on the smaller equity. For the previous year payments were interim 4% and final 11% on £240,000.

Gross revenue is up to £132,908 (*£105,240*) and net revenue £56,625 (*£43,733*) after tax of £45,849 (*£36,320*).

Nigerian Electric Supply

Final dividend is 4% which plus bonus of 2% makes total of 10% for year to 28 Feb., 1955 (*same*). After depreciation of £60,000 (*same*) there is a net profit of £111,358 (*£111,044*). Added to this is tax over provision of £2,316 (*£6,130*) and deducted £60,687 (*£62,300*) so that there is a balance of £32,987 (*£34,874*) with £20,000 allotted to plant replacement reserve (*same*).

Nico Light Engineering

Trading profit is £41,406 (*£38,875*) and net profit £9,400 (*£8,494*) £4,000 (*same*) goes to building reserve leaving £10,870 (*£10,138*) carry forward. Dividend for year ended 31 Mar., 1955, is 10% (*same*) plus bonus 5% (*10%*).

Oriental Telephone and Electric

Final ordinary dividend of 1s. 9·6d. per 1s. unit less tax or 1s. 0·42d. net makes total distribution (gross) of 25% before recent repayment of capital of 19s. per unit (16s.% per £1 unit).

Group profit after all charges £183,601 (*£211,549*) all attributable to holding company. U.K. tax takes £68,418 (*£51,415*) and tax equalisation reserve £46,000 (*£3,027*). After provision for tax in respect of prospective withdrawal of taxation capital allowances received in respect of fixed assets acquired by Governments of Malaya and Singapore and additional profits tax £145,000 (*nil*) to be paid in the event of distribution of retained profits to members in the course of liquidation there is left for carry forward 1955 £182,967 (*£293,559*).

Thorn Electrical Industries

The remarkable expansion of this company noted in our issue of 2 Sept. last year is carried one step forward with the results of the year's trading published last week and shown in our table.

Year to	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1951	517,323	155,218	51	10*	12/2	8/3
1952	681,169	195,885	66	12½	8/9	7/0
1953	771,292	192,074	62	12½	13/16	7/10
1954	1,054,348	293,608	97	20	24/6	13/3
1955	1,501,612	532,497	84·6‡	15†	33/–	13/1d

*Plus 100% capital bonus issued March 1951.
†Plus 100% capital bonus issued May 1955.
‡On increased capital

The company is expanding its resources and is preparing still further to meet the challenge of world competition. Current assets in all £7,150,602 against £5,406,440 for last year, whilst liabilities amount to £4,886,627 against £3,753,923.

Westinghouse Brake and Signal

The directors are asking for borrowing powers to be increased to £6,724,833, from £3,076,192, arrived at on the basis of the last consolidated balance sheet as a figure equal to nominal amount of issued capital, plus aggregate capital and revenue reserves (including share premium account) and profit and loss account of company and its subsidiaries.

Also proposed is the increase of authorised capital to £3½m. by the issue of 1,000,000 new shares of £1. (Present authorised capital is £2½m. with 449,205 shares unissued.)

Dividends Declared

Assoc. Insulation Products Ltd. 2nd Interim dividend of 12% less tax in place of usual final dividend due to delay in submitting accounts.

English Electric Co. Interim Dividend of 4% less tax payable 15 Sept.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

20 Aug.—Arnold U.D.C. Concrete columns for street lighting in Breck Hill Rd.—See 4 Aug. issue.

20 Aug.—Penge U.D.C. Group A and B concrete columns, with lanterns, etc.—See 28 July issue.

20 Aug.—Whitefield U.D.C. Group A concrete columns, sodium discharge lamps, lanterns, etc., along Higher Lane and Ringley Rd.—See 11 Aug. issue.

23 Aug.—Liverpool T.C. Installation at Heygreen Rd C.P. school; and St. James' secondary modern school.—See 11 Aug. issue.

24 Aug.—Carlow (Eire) U.D.C. Duplicate electrically driven pumping plant near Sion Cross.—See 28 July issue.

25 Aug.—Dublin. Installation at Iveagh Hse, St. Stephen's Green.—See 4 Aug. issue.

26 Aug.—Aylesbury T.C. Installation in 100 houses on Gatehouse estate.—See 11 Aug. issue.

26 Aug.—Belfast T.C. Automatic fire fighting installation and medium voltage substation distribution board.—Advertised in 4 Aug. issue.

27 Aug.—Caerphilly U.D.C. Group A lighting standards with sodium lamps at Nelson.—See 11 Aug. issue.

27 Aug.—Preston R.D.C. Class A and B street lighting schemes on Liverpool Rd, Leyland Rd, and along three lanes, and conversion scheme along side roads, in parish of Penwortham.—Advertised in 4 Aug. issue.

27 Aug.—Reigate T.C. Street lighting equipment on Reigate-Hockwood Rd and London-Castlefield Rd.—Advertised in 4 Aug. issue.

27 Aug.—West Lothian. Repair and maintenance of electrical installation and equipment at hospitals in W. Lothian (Bangour) Hospital Group. Secretary, Board of Management Office, Bangour Hospital, Broxburn.

27 Aug.—Wrexham R.D.C. Installations in 97 houses and bungalows on five sites.—See 4 Aug. issue.

29 Aug.—Derby T.C. Class A sodium discharge lighting units along A.5111 trunk road.—Advertised in 11 Aug. issue.

29 Aug.—East Riding. Installation at county secondary school at Pocklington.—See 11 Aug. issue.

29 Aug.—King's Lynn T.C. Erection of 147 25 ft tubular steel columns and five 15 ft concrete columns, and supply and fixing of sodium vapour discharge and fluorescent mercury discharge vapour discharge lamps, etc., for street lighting improvements. Borough Engineer, H. G. Ridler, Crofton Hse, 17 Queen St.

29 Aug.—Lancashire. Supply of 23 items of electrical equipment, including water heaters, fires, cookers, lamps, refrigerators, etc., for County Council. Apply to County Architect, County Hall, Preston, by above date.—Advertised in this issue.

29 Aug.—Littlehampton U.D.C. Electrical installation in 12 houses on Wickbourne estate. Council's Engineer and Surveyor, Council Offices. Deposit £1. 1s.

29 Aug.—Preston. Street lighting equipment for Class A scheme in Blackpool Rd, Lea, and Class B scheme.—Advertised in 28 July issue.

29 Aug.—Taunton T.C. Supply and erection of 96 140 W sodium lighting units on concrete columns, and supply and laying of 1,600 yd ·0145 sq in 2-core lead covered cable along A.38. Borough Engineer and Surveyor, St Paul's House. Deposit £2. 2s.

30 Aug.—Basingstoke (Hants). Lamps to Park Prewett Hospital in year from 1 Oct.—See 4 Aug. issue.

30 Aug.—Dublin. Removal and replacement of existing installation at St Kevin's Instn. It involves lighting, cooking, nurses' call, wireless and power. N. Mathews, consulting engineer, 42 Fitzwilliam Place. Deposit £10.

31 Aug.—Seaham U.D.C. Materials for maintenance of 3,600 houses for one year.—See 4 Aug. issue.

1 Sept.—Batley (Yorks). Rewiring at Batley General Hospital.—See 4 Aug. issue.

1 Sept.—Friern Barnet U.D.C. Lanterns, etc., for sodium lighting and Group A concrete columns and dismantling steel columns on N. Circular Rd.—See 11 Aug. issue.

1 Sept.—Co. Limerick. Installation in Courtenay Boys' school.—See 11 Aug. issue.

1 Sept.—New Windsor T.C. Installation in reconstruction work at Alma Rd Depot.—See 4 Aug. issue.

2 Sept.—Stranraer T.C. Mercury vapour Class A street lighting lanterns, control gear, steel columns, etc.—See 11 Aug. issue.

2 Sept.—Sunderland T.C. Installation at Castle View primary junior schools.—See 11 Aug. issue.

3 Sept.—Alsager U.D.C. Supply and erection of Group A street lighting involving 30 concrete columns and 140 W sodium lamps. Surveyor, Council Offices. Deposit £2. 2s.

3 Sept.—Failsworth U.D.C. Group B columns, sodium and tungsten lamps, etc., for street lighting.—See 11 Aug. issue.

3 Sept.—Rothwell (Yorks) U.D.C. Supply and erection of 81 45 W sodium discharge street lighting units on concrete columns on Wood Lane estate. Engineer and Surveyor, Civic Bldgs. Deposit £2. 2s.

5 Sept.—Carlisle T.C. Installation in 252 dwellings.—See 11 Aug. issue.

5 Sept.—Cheltenham T.C. Group A sodium discharge lighting along Bath to Lincoln trunk road.—Advertised in 4 Aug. issue.

5 Sept.—Heckmondwike U.D.C. Installation in 10 houses on Dale Lane estate.—See 11 Aug. issue.

5 Sept.—Hereford T.C. Supply and erection of about 32 Group B concrete columns with sodium discharge lamps. F. Margerison, City Surveyor, Town Hall. Deposit £2. 2s.—Advertised in this issue.

5 Sept.—Kincardine. Installation in 50 houses at Portlethen Station.—See 11 Aug. issue.

5 Sept.—West Hartlepool T.C. Installation in 114 three-storey flats on Owton Manor estate.—See 11 Aug. issue.

6 Sept.—Chertsey U.D.C. —Supply and installation of tungsten lamps, lanterns, and fittings, with concrete columns for improved Group B street lighting in New Haw and Addlestone area. Engineer and Surveyor, Council Offices, Guildford St. Deposit £1. 1s.

7 Sept.—Bedwellty U.D.C. Installation of 140 W sodium discharge Group A street lighting systems along about 11 miles of A4048, A4049 and A469. Engineer and Surveyor, Municipal Offices, Aberbargoed, Bargoed, Glamorgan. Deposit £2. 2s.

7 Sept.—Kingussie (Inverness) T.C. Steel columns, lanterns, lamps, etc., for sodium lighting along A.9.—See 28 July issue.

7 Sept.—Manchester T.C. Electrical installation at Wythenhawe fire station. City Architect, P.O. Box 488, Town Hall. Advertised in this issue.

8 Sept.—Luton T.C. Erection and wiring of about 780 Class B concrete columns with sodium discharge lighting, and conversion of about 140 existing Class A units from tungsten filament to sodium

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 97 queries answered this week

"Cavendish" convector heater, makers of? P.E.—H.M.V. Household Appliances, Blyth Rd, Hayes, Middx.

"V" superimposed on "p" bearings, makers of? C.E.—Vandervell Products Ltd., Western Ave, Acton, W.3.

Shoedryers, makers of? E.M.B.—Ronning and Co., Ltd., 150 Fleet St, E.C.4.

"Relyon" time-switch movements, makers of? W.G.W.—Synchro Time Systems Ltd., Sectric Hse, Waterloo Rd, N.W.2.

"Clem" products, address for? J.E.E.—A.B. Metal Products Ltd., 17 Stratton St, W.1.

"Arora" fires, makers of? D.H.—Electroway Heaters Ltd., Loughborough, Leics.

"Tempo" pressure cookers, address for? A.W.—Tempo Aluminium Ltd., 46 Pembridge Rd, W.11.

ANSWER WANTED

"Simfold" travelling irons, makers of? M.B.

lighting. Borough Engineer, Town Hall. Deposit £2. 2s.

8 Sept.—Rhyl U.D.C. Supply and erection of 79 Class A concrete columns with 140 W sodium vapour discharge lanterns on Coast Rd and Rhuddlan Rd. Surveyor, Council Offices.

9 Sept.—Belfast T.C. Extensions to and modifications on existing Reyrolle switchboards at six substations; and five outdoor transformers.—Advertised in 21 July issue.

9 Sept.—Bilston T.C. Supply and erection of 121 140 W sodium Group A lamps on concrete columns and 78 60 W sodium Group B lighting units on various roads. Borough Engineer, 20 Wellington Rd. Deposit £2. 2s.

9 Sept.—Edinburgh T.C. Installation in houses in Coniston area and Loaning Rd. —See 11 Aug. issue.

10 Sept.—Cambridge T.C. Supply of electric lamps in year from 1 Oct. City Engineer and Surveyor, The Guildhall.

10 Sept.—Wirral U.D.C. Provision of about 1¼ miles of Group B street lighting at Heswall. Surveyor, Council Offices, Heswall.

12 Sept.—Sutherland. Electrical installation in Durine J.S. school extensions, Durness. County Architect, County Offices, Dornoch.

14 Sept.—East Grinstead U.D.C. Supply and erection of 15 25 ft steel columns, resiting four existing columns and supply and fixing of 34 new lanterns and lamps along London to Eastbourne Rd. Scheme is for in-filling existing 140 W sodium discharge lighting. B. J. Cornelius, Surveyor to Council, East Court. Deposit £2. 2s.

14 Sept.—Tunbridge Wells T.C. Concrete street lighting columns in Class B with lanterns, etc., for Sherwood estate extensions, Liptraps Lane and industrial estate.—See 11 Aug. issue.

17 Sept.—Bebington T.C. Automatic private telephone exchange in new town hall.—See 11 Aug. issue.

17 Sept.—Belfast. Supply and erection of two electrically-driven drainage pumps at Alexandra Graving Dock for Harbour Commissioners. Harbour Engineer, Harbour Office.

19 Sept.—Kingston-on-Thames T.C. Supply of six sets of electrically driven vertical unchokeable sewage pumps under Contract 4. John Taylor and Sons, Artillery Hse, Artillery Row, Westminster. Deposit £5.

19 Sept.—Waterford (Eire). Installation at Central Technical Inst., Parnell St.—See 28 July issue.

22 Sept.—Belfast T.C. 10-ton overhead travelling crane and two electric hoist blocks for Power Station West extension. —Advertised in 11 Aug. issue.

26 Sept.—Newcastle-on-Tyne. Two 6-ton semi-portal electric cargo cranes for Tyne Commission Quay extension.—See 11 Aug. issue.

1 Oct.—Islington B.C. Rewiring of the Council's Public Baths, Greenman St. —Advertised 14 July issue.

10 Oct.—Stockport T.C. Rewiring of electrical installation at town hall. Apply to Borough Surveyor by 5 Sept. Deposit £5. 5s.

14 Oct.—Edinburgh T.C. Electrical installation in 47 houses in Craighall Rd, Eversley. Apply by 1 Sept. to City Architect, City Chambers.

No date stated.—Kirkcaldy T.C. Electrical installation in crematorium at Dunnkier Park. James Gentles and Son, quantity surveyors, Osborne Hse, Kirkcaldy, or 3 Hill St, Edinburgh.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 16 August

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	362	+1	235½
,, (3 months)	352	−4	233½
R.T.S. (Rhodesian Selection Trust) group price*	325	—	—
LEAD, refined pig, min. 99·97% purity (cash)	105½	−½	97½
,, (3 months)	105	−½	94½
TIN, refined, min. 99·75% purity (settlement)	753	−1	731
,, (3 months)	748	−½	731
ALUMINIUM, ingots 99·99·5%	171	—	156
ZINC, virgin, min. 98% purity (cash)	89½	−1	74½
,, (3 months)	81½	−9	75
RUBBER No. 1, RSS, spot (per lb.)	39¼d.	−3¼d.	20¼d.
,, c.i.f. basis, ports, Oct. (per lb.)	39¼d.	−3¼d.	19 11/16d.
ARMOURING :			
Galv. Steel Wire (0·104 in.)	56½	—	52
Mild Steel Tape (0·014 in.)	43½	—	40½

(*Fixed price c.i.f. U.K., operative till end of August and then subject to change at 24 hours' notice, to "consumers willing to instil a degree of stability into the resale price.")

No date stated.—N. of Scotland H.E. Board. Construction of about 193 miles of h.v. and l.v. wood pole overhead lines, etc., in Ardnamurchan and Morven district. Kennedy and Donkin, 3 North Charlotte St, Edinburgh. Deposit £2. 2s.—Advertised in this issue.

No date stated.—Wigan T.C. Applications invited from manufacturers wishing to be included on approved list for invitation of tenders for supply of dual fuel engines and generators, cranes and lifting gear, electrical transmission lines and equipment, etc., at Hoscar sewage disposal works. Allan Royle, town clerk, Municipal Bldgs, Library St.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

2 Sept.—Rhodesia. Tenders (No. 2248) invited for supply of some 20 diesel generator power plants from 2 kVA to 12 kVA. Controller of Stores and Transport, P.O. Box 8048, Causeway, S. Rhodesia. B.o.T. (Ref.: ESB 16394/55).*

7 Sept.—Pakistan. Tenders (PUR 7-3/55/87) invited for supply of total of 71 items of telegraph materials and accessories in various quantities. Pakistan Posts and Telegraphs Dept., Karachi. B.O.T. (Ref.: ESB 16434/55).*

7 Sept.—South Africa. Supply of one 300 kVA, 11 kV primary volts, 400 V secondary, 3-phase, 50 c/s transformer. Tender No. C.256, Stores Dept., S. African Railways, Johannesburg. B.o.T. (Ref.: ESB 16690/55).*

14 Sept.—Portuguese E. Africa. Supply of total of 28 items of electrical equipment, including lamps, plugs, copper wire, switches, insulating paper, etc. Ports, Railways and Transport Dept., Lourenco Marques. B.o.T. (Ref.: ESB 16435/55).*

15 Sept.—Uruguay. Supply of lead covered and plastic insulated (PVC) one-pair telephone cables. Tender No. 4193/55. Administration General de las Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 16369/55)..*

19 Sept.—India. Damodar Valley Corpn's Electricity Dept. invites tenders (No. ED 712-4) for supply of two 20 MVA and four 10 MVA 132-33 kV Core/Shell type power transformers for Eastern Railways at Howrah, Burdwan and Belmuri. Documents from Dep. Chief Electrical Engineer of Corpn., Anderson Hse., Alipore, Calcutta 27, at Rs 50 per copy. B.o.T. (Ref.: ESB 16383/55).*

4 Oct.—Egypt. Supply and erection of five transformer stations at Edfina, El Abbassah Sammanoud, Nag-Hammadi and Beni Suef, together with switchgear, etc. Director-General, Mechanical and Electrical Dept., Ministry of Public Works, Cairo. B.o.T. (Ref.: ESB 16313/55).*

12 Oct.—Australia. Supply of 18 circuit-breakers, a resistor and 42 transformers of various types for State Electricity Commission of Queensland, Scottish Union Hse., Eagle St, Brisbane. Specif. TF/29. B.o.T. (Ref.: ESB 16279/55).*

12 Oct.—Australia. State Electricity Commission of Queensland invites tenders (specif. No. TF/36) for main transformers operating at 132 kV, 66 kV and 11 kV, and shunt reactors operating at 11 kV, for Tully Falls power station and Townsville and Ingham substations. Commission is at Scottish Union Hse, Eagle St, Brisbane. B.o.T. (Ref.: ESB 16221/55).*

14 Oct.—Australia. Contract E.24/55 calls for manufacture, supply, etc., of coal handling plant at Tennyson power station together with all accessories and auxiliaries. Documents from Chief Engineer and Manager, Dept. of Electricity, Brisbane City Council, Adelaide St, at 10s. 6d. per copy. B.o.T. (Ref.: ESB 16298/55).*

No date stated—Mauritius. Supply to Central Elect. Board of oil circuit-breakers, transformers, etc., for 22/6·6 kV switching station. Documents from Crown Agents, 4 Millbank, London, S.W.1, quoting ref.: EM1/Mauritius C.E.B. 5.—Advertised in 11 Aug. issue.

Contracts Placed

Durham. Installation at Shire Hall, Dougal and Railton, £3,094, same at Stockton fire station, N. of England Engineering and Electrical Co., Ltd., £1,097; and 12 months' supply of lamps for Shire Hall, Luxram Electrics Ltd.

Glasgow T.C.. Supply of cable, etc., for Rutherglen trolleybus extension scheme, Scottish Cables Ltd., £11,223, and Hackbridge Cable Co., Ltd., £292.

Hornsey (Middx). Supply, installation, etc., of cables, conduit, in electrification of Campsbourne pumping station for Metropolitan Water Board, Pulver and Co., Ltd., £1,091.

BUSINESS PROSPECTS

Anglesey. Erection of county primary school at Llanfawr, Holyhead. County Architect, Shire Hall, Llangefni.

Bedford T.C. Total of 80 houses to be built in Meadway, Barnhill, Queen's Drive, Houndmead and Downside areas. Also 11 houses on Putnoe estate.

Blackwell (Notts) R.D.C. It is proposed to erect 84 dwellings at Thickley Bank, Shirebrook. Bills of quantities being prepared.

Carrickmore (Tyrone). Construction of primary school at Creggan. John Tynan, 68 Royal Ave, Belfast.

Dunbartonshire. Dean of Guild Court has approved works extensions to cost about £56,500 for J. Brown and Co. (Clydebank) Ltd.

Easington (Dur) R.D.C. Erection of 50 houses at Easington and Horden. J. W. Gray, clerk of council, Council Offices.

East Retford T.C. Erection of 36 dwellings at Spital Hill, Borough Surveyor, Municipal Offices, Retford.

Gosforth (Northumb). Development of land at Fawdon Farm providing for over 700 houses being planned by William Leach Ltd., builders, 2 Clayton St, Newcastle.

Trade Notes

Beama Contract Price Adjustment Formulæ.—*For Electrical Machinery and Equipment* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 Aug., 1955, shall be deemed to be 162s.; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry published in the Board of Trade Journal on 13 Aug., 1955, is 182·2.

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 Aug., 1955, shall be deemed to be 162s.; (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on 13 Aug., 1955, are: Materials used in Mechanical Engineering Industries—166·1, "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—149·55. The price of brass condenser tubes, ¾ in. o/d 18 s.w.g. published in *The Metal Bulletin* on 12 Aug., is 4s. 5¼d. per lb.

For Outstanding Contracts covered by the B.O.T. Intermediate Products Index. For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 Aug., 1955, shall be deemed to be 162s. (*b*) "Cost of Material"—the index figure for Intermediate Products published in the Board of Trade Journal on 13 Aug., 1955, is 376·3.

New Phone Nos. Metal Industries Ltd. have changed their telephone Nos. and added new lines at Universal Hse., Buckingham Palace Rd, S.W.1. In future their Nos. are Sloane 7192-4 and Sloane 5814 and 5618.

Phone No. of the accounts and sales depts. of Sunvic Controls Ltd., Eastern Industrial Estate, Harlow, Essex, has been changed to Harlow 25271.

Change of Address. As from Tuesday (16 Aug.) Bective Electrical Co., Ltd., have transferred to larger offices at 40-42 Parker St, Kingsway, London, W.C.2. Tel.: Chancery 9168. Stores Dept. will be at 49 Goding St, Vauxhall, S.E.11. Tel.: Reliance 5725.

Liverpool T.C. Housing Committee approved in principle erection of 11-storey tower flats overlooking Sefton Park review field.

Manchester. Plans approved for factory and offices in Sheltonfield Rd, Northenden, for Disinerustant Marseillais Co., Ltd. Francis Jones and Son, 180 Oxford Rd, are architects.

Mynyddislwyn R.D.C. Erection of 34 houses at Pontllanfraith. Engineer and Surveyor, Council Offices, Pontllanfraith, Blackwood, Mon.

Newcastle-on-Tyne. Erection of total of 29 police houses on various sites. City Architect, 18 Cloth Market.

Perth T.C. Approval given to erection of 100 houses for Scottish Special Housing Assoc.

Rochester. Negotiations in hand for 12 acre site for erection of processed food can factory for Metal Box Co., Ltd. Building to begin soon.

Romford T.C. Tenders may soon be sought for erection of 78 houses and 24 flats in Straight Rd site. Approval sought for 100 houses and 28 flats in Lodge Lane.

Sandbach U.D.C. Construction of 34 houses and 4 bungalows in Elworth Rd and Platt Ave. H. J. Rees, Engineer and Surveyor, Council Offices, Crewe Rd.

Silvertown. Tate and Lyle Ltd. to spend £200,000 on extensions to Thames Sugar Refinery.

Spennymoor (Dur) U.D.C. Application to be made to borrow £83,850 for erection of 65 houses at Middlestone Moor.

Tottenham B.C. Erection of 24 dwellings in Tewkesbury redevelopment area. Borough Engineer and Surveyor, Town Hall, N.15.

Wandsworth B.C. Development of second portion of West Hill site will involve 216 dwellings. Architect is Sir Lancelot Keay, 80 Wimpole St, W.1.

Workington. Training centre at Moss Bay for Workington Iron and Steel Co. estimated to cost £35,000. J. Telford Hart, Natproban Chambers, Victoria Viaduct, Carlisle, is quantity surveyor.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Washing Machine Hire Ltd., Dacre Place, Dacre Pk, Lee, S.E.13. Hiring, selling, manufacturing and factoring of washing machines, etc. Nom. cap.: £2,000. Dirs.: D. H. Cox, V. H. D. Hennell, and W. E. Ratcliff.

Electronic Services (Cardiff) Ltd. Rhymney Terrace, Cathays, Cardiff. Nom. cap.: £2,000. Dir.: C. W. Davies.

Leafield Engineering Co., Ltd. Mechanical, electrical, electronic and electromechanical engineers, founders, smiths, etc. Nom. cap.: £1,000. Dirs.: I. A. C. Brixey, Ferlea, 46 Leigh Rd, Holt, Notts; N. Wiltshire, 4 Elm Grove Ave., Corsham; E. R. Thomas and A. Black.

R. and W. Cushway and Co., Ltd., Trevelyan Hse, Arewater Green, Loughton, Essex. Precision, mechanical, electric, motor, wireless and radio engineers, etc. Nom. cap.: £1,000. Dirs.: R. W. Cushway, W. E. Cushway and Mrs E. Cushway.

Atkinson Evaporators Ltd. 1/2 Greycoat Place, S.W.1. Manufacturers of and dealers in electrical appliances, fittings and equipment of industrial and domestic application, etc. Nom. cap.: £100. Dirs.: F. C. Austin, L. J. Wolf and F. V. Atkinson.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Farben. 740,932. Class 7. Boring, turning, milling, grinding, shaping machines, etc., Benrath Machine Tools Ltd., Longley Lane, Wythenshawe, Manchester.

Roadmaster. 742,023. Class 7. Ignition coils. Walker-Tyseley (Electrical) Ltd., 264 Kings Rd, Tyseley, Birmingham 11.

Heclaweld. 741,645. Class 9. Electrodes for welding. Hadfields Ltd., East Hecla Works, Vulcan Rd, Tinsley, Sheffield 9.

Gazette Announcements

COMPANIES ACTS

Hertford Refrigeration Services Ltd. Petition for winding-up presented on 5 Aug. and directed to be heard at Royal Courts of Justice, Strand, London, on 10 Oct. Interested parties should contact Samuel Tonkin and Co., solicitors, 3 Berners St, London, W.1, by 8 Oct.

Dalmere Electronics Ltd. Creditors are requested to send particulars to S. Percy Heath, of Messrs Joseph W. Shepherd and Co., incorp. acc., 78 King St, Manchester 2, the liquidator, by 31 Aug.

H. Lawrence Electrical Ltd. Meetings of members and creditors will be held at 91 Moorgate, London, E.C.2, on 15 Sept. at 12 noon and 12.30 a.m. to receive liquidator's report.

Betterway Electrical Products Ltd. Meeting of creditors takes place today (Thurs.) at 69 London St, Norwich, at 10 a.m., to receive liquidator's report.

BANKRUPTCY ACTS

Appointment of Trustee

Tunbridge Wells. John H. Pickwell, trading as J. H. Pickwell and Co., electrical retailer, at 79 London Rd, East Grinstead, and electrical contractor at 108 London Rd, East Grinstead. Trustee is J. S. Bradley-Hole, cert. acc., 7 Old Steine, Brighton.

Release of Trustees

Birmingham. Wilfred J. Layton, electrical engineer trading at 102 Evesham St, Redditch. Trustee was R. K. Clark, Official Receiver, Somerset Hse, 37 Temple St, Birmingham.

Boston. Leslie J. Anthony, trading at 6 Dolphin Lane, Boston, as Dolphin Electric Co. Trustee was C. G. Compton, incorp. acc., 2 New St, Boston.

Public Examination

Birmingham. Cecil A. Smith trading as Birmingham Electric Co. at 4 Gothic Arcade, Snow Hill. Public exam. will be at The Court Hse., Corporation St, Birmingham, on 2 Nov., at 10.15 a.m.

Order on Applic. for Discharge

Croydon. Douglas Cromwell and Valerie I. Cromwell, trading together as Cromwell and Co., makers of electrical fittings, lampshades, etc., at Croydon, Forest Hill and Streatham Hill. Order made on 30 June. D. Cromwell: discharge suspended for nine months, and that he be discharged as from 30 Mar., 1956. V. J. Cromwell: discharge suspended for three months until 30 Sept., 1955.

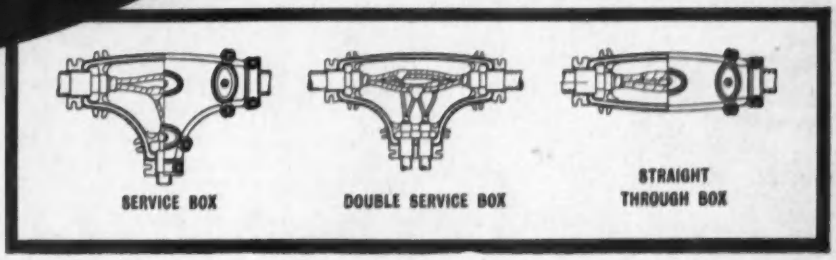
Coming to grips with a cable...

A. Bridge piece for securing shuttle. B. Filling cover. C. Cast-iron armour clamp. D. Cast-iron shuttle. E. Lead-tin alloy bonding strip on armouring. F. Lead-tin alloy bonding strip on lead sheath.

Henley Cablegrip Straight Through Service and Branch boxes of cast-iron construction, have all the essential requirements necessary for boxes of this kind, including the famous Henley Cablegrip gland.

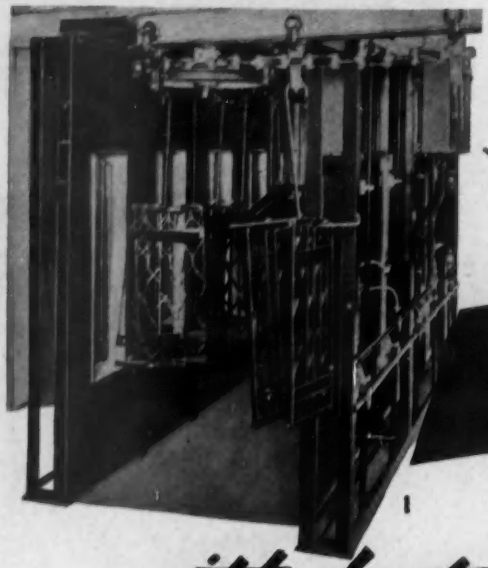
The gland and armour clamp provides two wide bearings for the cable. A highly efficient bond to the lead sheathing is effected by means of a cast-iron shuttle and to the armouring by means of an armour clamp.

Suitable for P.L. and armoured cables—660 volts.
Send for Catalogue 26.



Cablegrip STRAIGHT THROUGH SERVICE & BRANCH BOXES by HENLEY

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD. · 51-53, HATTON GARDEN · LONDON, E.C.1



WELL AHEAD —

...with faster, better finishing

Metrovick Infra-red plant is already used by an important section of the motor industry for drying and stoving products ranging from small accessories to complete bodies. Process time is cut and the finish obtained is more durable.

Metrovick specialist engineers will be glad to help you to obtain a faster and better finish on your products.

2

3

1. *Ten 4 kW projectors used by Messrs. Morris Commercial Cars Ltd. In this plant large car sections are stoved in 14-16 minutes.*

2. *Metrovick Infra-red installation used by a world famous manufacturer of quality cars for paint stoving of engine components.*

3. *This plant at the works of the Metropolitan Cammell Carriage & Wagon Co. Ltd. is fitted with ten 6 ft. 6 in. Metrovick Infra-red element projectors each with a loading of 6 kW. It is used for the paint stoving of aluminium panels.*

METROPOLITAN-VICKERS

ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

Member of the AEI Group of Companies

Leaders in Industrial Process Heating

L/I.501

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

LANCASHIRE COUNTY COUNCIL

APPLICATIONS are invited for the supply of the following ELECTRICAL AND OTHER EQUIPMENT to the Lancashire County Council. The successful firms will be required to deliver to County premises in both large and small quantities, and the contracts will be on an annual basis.

Electrical Equipment:
(*a*) Immersion Heaters,
(*b*) Water Heaters,
(*c*) Sewing Machines,
(*d*) Pottery Kilns,
(*e*) Experimental Power Units,
(*f*) Vacuum Cleaners,
(*g*) Food Mixing Machines,
(*h*) Electric Fires,
(*j*) Radio Sets,
(*k*) Stage Equipment,
(*l*) Washing Machines,
(*m*) Refrigerators,
(*n*) Schools Broadcast Equipment,
(*o*) Kettles,
(*p*) Drying Cabinets,
(*q*) Hair Dryers,
(*r*) Floor Scrubbers and Polishers,
(*s*) Irons,
(*t*) Domestic Cookers,
(*u*) Clocks,
(*v*) Lamps,
(*w*) Fluorescent Tubes,
(*x*) Wash Boilers.

Mechanical Equipment:
Woodwork and Metalwork Tools and Machinery,
Clocks,
Sewing Machines.

Gas Equipment:
Water Heaters,
Domestic Cookers,
Radiant Heaters,
Domestic Wash Boilers.

Technical Drawing Equipment:

If any further electrical items are required, firms to tender will be drawn from a list of those replying to this advertisement.

Firms desiring to tender should make application to the County Architect, County Hall, Preston, not later than 29 Aug., 1955, indicating for which item, or items, they wish to quote. (T 808)

CITY OF HEREFORD

TENDERS FOR STREET LIGHTING—MAIN ROADS, TO GROUP "B" STANDARD

TENDERS are invited for the provision, erection and putting into service of street lighting columns and lanterns on Main Roads in the City.

The scheme allows for approximately 32 sodium discharge lamps on concrete columns.

Specifications, Schedules and Forms of Tender may be obtained from Mr F. Margerison, A.M.I.C.E., City Surveyor, Town Hall, Hereford, on receipt of £2. 2s. which will be returned on receipt of a bona-fide tender.

Plans and Conditions of Contract may be inspected at the same office during normal office hours.

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Tenders endorsed "Street Lighting" in the envelope provided, and bearing no name or mark to indicate the sender, must reach the undersigned not later than 9 a.m., Monday, 5 Sept., 1955.

The Council do not bind themselves to accept the lowest or any tender.

T. B. FELTHAM,
Town Clerk.

Town Hall,
Hereford. (T 805)

CITY OF MANCHESTER

THE Watch Committee invite tenders for the ELECTRICAL INSTALLATION required at Wythenshawe Fire Station, Manchester. Specification and Tender Form, etc., may be obtained from the City Architect, P.O. Box No. 488, Town Hall. Tenders, sealed in endorsed envelopes, must be delivered before 10 a.m. on 7 Sept., 1955.

PHILIP B. DINGLE,
Town Clerk.

Aug., 1955. (T 804)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
Ardnamurchan—Morven Distribution

TENDERS are invited for the construction of approximately 193 miles of high and low voltage wood pole overhead lines together with associated services in the Ardnamurchan and Morven District. Tender Documents may be obtained on application with a cheque for £2. 2s. (returnable) to Messrs Kennedy and Donkin, 3 North Charlotte St, Edinburgh 2. The Board do not bind themselves to accept the lowest or any Tender. H. W. Simpson, Secretary, 16 Rothesay Terr, Edinburgh 3. (T 843)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

NORTH THAMES GAS BOARD
Distribution Department

APPLICATIONS are invited for the post of TECHNICAL ASSISTANT on the Headquarters staff of the Distributing Engineer.

Applicants should be University Graduates in Civil, Electrical or Mechanical Engineering, and/or hold Corporate Membership of the corresponding Institutions. Although no experience in Gas Distribution Engineering will be required of the candidate, he should be fully conversant with the practical application of physical and engineering principles.

Starting salary, depending on age and qualifications will be within the range £600/£850 per annum. The successful candidate will be required to join the Staff Pension Scheme.

Applications stating age and giving full details of qualifications and experience should be sent to the Staff Controller, North Thames Gas Board, 30 Kensington Church St, W.8, quoting ref. 666/277. (T 793)

LONDON ELECTRICITY BOARD
SENIOR AND ENGINEERING DRAUGHTSMEN

APPLICATIONS are invited for the following vacancies. These posts are permanent and superannuable and they are graded under Schedule D of the National Joint Board agreement.

ENGINEERING DRAUGHTSMEN

Commencing salaries dependent upon qualifications and experience within Grade 6, £535, 10s./£661, 10s. per annum, inclusive of London Allowance.

North Eastern Sub-Area
(BASED AT STRATFORD, E.15)
Vacancy No. V/2012/T

Candidates should have had a good general and technical education and be experienced in one or more of the following subjects: engineering drawing; plant layout in substations: layouts and site plans of mains work; electrical diagrams.

St. Marylebone/St. Pancras District
(DESIGN AND PLANNING)
Vacancy No. V/1967/T

Applicants should have had a good general and technical education in electrical engineering and building construction, and experience in a mains records office dealing with systems of all voltages up to 11 kV.

Southern Sub-Area
(BASED AT BECKENHAM, KENT)
Vacancy No. V/1980/T

Candidates should have had a good general and technical education up to Ordinary National Certificate standard, be neat and capable draughtsmen and experienced in one or more of the following subjects: drawing office routine, electrical diagrams, layout of plant in transformer chambers, mains survey and recording of mains work.

Chief Engineer's Department
(AT STAMFORD ST., S.E.1)
Vacancy No. V/1989/T

Candidates should be experienced in surveying E.H.V. cable routes and have had good experience in making accurate surveys of cable routes during the laying of E.H.V. cables, taking information and sketches on site and producing final drawings.

Chief Engineer's Department
(AT STAMFORD ST., S.E.1)
Vacancy No. V/1989/T

Applicants, required for plant layout, should preferably have served an engineering apprenticeship and have had technical training to Ordinary National Certificate level, together with experience in the layout of transforming plant, H.V. switchgear and cables up to 66 kV. (In this instance an appointment may be made within Grade 5, £672/£777 per annum inclusive.)

SENIOR DRAUGHTSMEN

Commencing salaries dependent upon qualifications and experience within Grade 5, £672/£777 per annum, inclusive of London Allowance.

Contracting Section
(AT STRATFORD PLACE, W.1)
Vacancy No. V/1986/T

Applicants should be capable of completing layouts of plant and associated cabling for large industrial installations.

St. Marylebone St. Pancras District
(AT AYBROOK ST, W.1.)
Vacancy No. V/2001/T

Applicants should have had a good general and technical education in electrical engineering and building construction, and experience in a mains records office dealing with systems of all voltages up to 11 kV. In addition, the applicant should be capable of supervising Engineering Draughtsmen and/or Junior Draughtsmen, if required.

Application forms for the foregoing vacancies are obtainable from the Personnel Officer, 46/7 New Broad St, London, E.C.2. Please enclose addressed envelope and quote reference No. of vacancy preferred. (T 351)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

THE BRITISH IRON AND STEEL RESEARCH ASSOCIATION

STAFF are required by the Plant Engineering Division for interesting and vital projects in connection with the further development of the Iron and Steel industry. The work will be mainly conducted in laboratories at Battersea, London, and opportunities will arise for periodical investigations at steel plants and for work in conjunction with manufacturers of plant.

The Division has sections covering new developments in electrical, mechanical and civil engineering. The research work in hand covers a wide field, including studies of motor drives, automatic control, mechanical handling techniques, the application of hydraulics, gas turbines for industrial use and stress measurements on such items of plant as rolling mills and cranes, to ascertain the capability of the plant to withstand additional loads and to improve its design.

The vacancies are mainly for graduate electrical, mechanical and civil engineers. Starting salaries of up to £800 will be assessed according to qualifications and experience. There is one vacancy for a research assistant with O.N.C. and preferably H.N.C. required for the civil engineering section. There is ample scope for advancement in all posts.

Persons interested are invited to send full particulars, including age, qualifications and experience to: The Personnel Officer, B.I.S.R.A., 11 Park Lane, London, W.1, quoting ref. "B.E.2." (T 791)

ELECTRONIC TECHNICIANS

THE United Kingdom Atomic Energy Authority, Aldermaston, Berks, requires several Technicians and Senior Technicians to be responsible for the inspection, testing, calibration to specification, fault finding and maintenance of electronic equipment such as oscilloscopes employing high-speed time basis, pulse generators, video amplifiers and stabilised power supply units. Equipments involved are in small quantities of widely varying design and the testing is of a non-routine nature and attendance at A.W.R.E. outstations and at contractors' works for short periods will be required. Successful applicants for the Senior Technician posts will be required to lead a team of Technicians on the above duties.

Applicants should have several years' approved practical training and experience on electronic testing and fault finding, and possess technical qualifications in this field to at least O.N.C. standard for the Technician posts and H.N.C. for the senior Technician posts.

Salary: Senior Technician £710 (linked to age 30)/£830 per annum (male). Technician £575 (linked to age 26)/£715 per annum (male). Contributory Superannuation Scheme.

Housing accommodation will be available on one of the Authority's estates within a reasonable period for married officers who now live outside the radius of the Establishment's transport facilities. Alternatively the Authority may be able to assist successful applicants in the purchase of a house. Until permanent accommodation is obtained a lodging allowance may be payable.

Requests for application forms by postcard to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote ref. 728/49. (T 789)

SOUTH WESTERN ELECTRICITY BOARD
Plymouth District
ASSISTANT ENGINEER

SALARY N.J.B. Class F, Grade 11—£595/£640 per annum.

Duties involve assistance in the construction, operation and maintenance of the distribution network including standby.

Applicants must have a sound general and technical education and experience in construction, operation and maintenance and L.V. and H.V. overhead and underground systems up to 33 kV.

Application forms obtainable from the District Manager, Armada St, Plymouth, are to be returned by 30 Aug., 1955. (T 819)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Wolverhampton and District Sub-Area
FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER (WALSALL DISTRICT)

Applicants should have had a sound technical training and a wide practical experience of industrial, commercial and domestic installations. The duties will include advice on utilisation, negotiations with consumers, preparation of estimates, etc., planning of contracting work and maintenance of consumer service. Technical qualifications desirable. Salary £790/£850 per annum (N.J.B. Grade F.6).

Apply in writing, within fourteen days, stating age, experience, present salary and position to Mr D. Holt, Sub-Area Manager, Midlands Electricity Board, 83 Darlington St, Wolverhampton.

Central Gloucestershire Sub-Area
THIRD ASSISTANT DISTRICT ENGINEERS (GLOUCESTER DISTRICT)

Applicants should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground distribution systems. Technical qualifications desirable. Salary £675/£720 per annum (N.J.B. Grade F.9).

Apply in writing, within fourteen days, stating age, experience, present salary and position to District Manager, Midlands Electricity Board, Commercial Rd, Gloucester.

Birmingham and District Sub-Area
GENERAL ASSISTANT ENGINEER (TECHNICAL SECTION, SUB-AREA ENGINEER'S DEPARTMENT)

Experience necessary in the preparation of specifications, layout of substations, and the planning of, and analysis of loading conditions on High Voltage and Low Voltage Transmission and Distribution Systems. Technical qualifications desirable. Salary £555/£600 per annum (N.J.B. Grade M.18).

Apply in writing, within fourteen days, stating age, experience, present salary and position to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

A. STEPHENS,
Secretary.
(T 833)

ASSISTANT LECTURER
Electrical Engineering

required for the Government of the Northern Region, Nigeria, for two tours of 18 to 24 months or three tours of 10 to 12 months in the first instance. Option of appointment either (*a*) on agreement with prospect of permanency with salary (including expatriation pay) in scale £750 rising to £1,315 a year or (*b*) on contract with salary (including expatriation pay) in scale £807 rising to £1,453 a year plus gratuity at the rate of £100/£150 a year. Commencing salary according to age, qualifications, experience and war service. Outfit allowance £60. Housing accommodation available for officer and family. Free passages for the officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Candidates should hold H.N.C. in Electrical Engineering or an equivalent qualification and have had previous teaching and industrial experience. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/30630/EE. (T 831)

HARLOW DEVELOPMENT CORPORATION

EXPERIENCED and qualified TECHNICAL ASSISTANT (Electrical) required. Salary £695 x £30 (4) x £20—£835 per annum.

Experience in heating and ventilating an advantage.

Accommodation available in 3-4 months in suitable cases. Superannuation.

Applications with copies of two recent testimonials within 7 days to General Manager, "Terlings," Harlow, Essex. (T 832)

YORKSHIRE ELECTRICITY BOARD
No. 7 (Grimsby) Sub-Area
THIRD ASSISTANT ENGINEER (SERVICE CENTRES, PUBLICITY AND DOMESTIC SALES)

APPLICANTS should have a sound training and experience in the work of the Consumers' Department and have particular experience of the work in connection with domestic and commercial supplies, and the control of Service Centres and staff.

Applicants should be suitably trained and/or technically qualified.

Salary—N.J.B. Class H, Grade 10, £715/£15/£760 per annum.

Grimsby District
DEMONSTRATOR

Applicants must have successfully completed a two years' full time course in domestic subjects at a recognised Training College and possession of the E.A.W. Certificate will be an advantage.

Salary—N.J.C. Grade 1, £425/£20/£525 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 1 Sept., 1955.

No. 5 (Wakefield) Sub-Area
Castleford District
THIRD ASSISTANT DISTRICT ENGINEER

Applicants must have had a sound practical training and experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants should hold a current driving licence, be prepared to reside in the district and undertake standby duties.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Salary—N.J.B. Class F, Grade 9, £675/£15/£720 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 1 Sept., 1955.

No. 2 (Huddersfield) Sub-Area
Halifax District
FOURTH ASSISTANT DISTRICT ENGINEER

Applicants should be Graduate Members of the Institution of Electrical Engineers or possess equivalent qualifications and have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Salary—N.J.B. Class H, Grade 11, £675/£15/£720 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 1 Sept., 1955. (T 816)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
Commercial Engineer's Department

APPLICATIONS are invited for the following appointment in the Commercial Engineer's Department:

COMMERCIAL ENGINEERING ASSISTANT. Salary commencing at a point within the range £1,250/£1,400 (N.J.M. Grade 1) with placing according to experience and qualifications. Candidates should possess good experience in commercial engineering, particularly in regard to tariff and consumers' problems. Superannuation Scheme applicable, and the successful candidate may be required to travel occasionally throughout the Board's Area. Application forms must be obtained and returned completed to the undersigned by 10 Sept., 1955.

The Secretary,
16 Rothesay Terr, North of Scotland
Edinburgh 3. Hydro-Electric Board.
(T 817)

CENTRAL ELECTRICITY AUTHORITY
North Eastern Division

APPLICATIONS are invited for the appointment of SHIFT CHARGE ENGINEER at North Tees "C" Power Station, Billingham on Tees.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Schedule A, Grade 7, Class J (£900/£975) per annum.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne 1, to whom they should be returned to arrive not later than 3 Sept., 1955. (T 828)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

METER TESTERS required in the Meter Department, Lister Drive, Liverpool. Rate of pay 4s. 1d. per hour, normal 44-hour, 5-day week, N.J.I.C. conditions, Superannuation Scheme. Applicants should have served a recognised apprenticeship and have had experience in the testing of all types of electrical meters and indicating and recording instruments. Applications by letter to the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3. Closing date 12 Sept., 1955. (T 829)

CENTRAL ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

MAINTENANCE ENGINEER (ELECTRICAL)
LONGFORD POWER STATION, COVENTRY

Vacancy No. 129/55/ET

Applicants should have received a thorough technical and practical training followed by considerable experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment and be capable of taking control of the electrical maintenance staff.

Preference will be given to candidates who are associated members of a recognised Institution or possess similar qualifications.

Salary will be in accordance with Class G, Grade 6 (£840/£900 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24 Aug., 1955.

MAINTENANCE ENGINEER (MECHANICAL)
CASTLE DONINGTON POWER STATION

Vacancy No. 130/55/ET

Applications from suitably qualified engineers are invited for the above position: candidates should have good administrative and organising ability and have experience in all aspects of the maintenance of modern large capacity high pressure turbo-alternators and pulverised fired boilers.

Apprenticeship at a large manufacturing works will be an advantage.

Salary will be in accordance with Class L, Grade 6 of the National Joint Board Agreement (£1,110/£1,200 per annum).

Closing date for receipt of applications, 24 Aug., 1955.

OPERATION AND EFFICIENCY ENGINEER,
CASTLE DONINGTON POWER STATION

Vacancy No. 131/55/ET

Candidates should have wide experience of the operation and maintenance of a large modern Generating Station with P.F. Boiler plant. The successful applicant will be responsible to the Station Superintendent for ensuring that all sections of the plant attain the specified efficiency and for the carrying out of special investigations and tests.

The possession of the Higher National Certificate or equivalent would be an advantage.

Salary will be in accordance with Class L, Grade 6, of the National Joint Board Agreement (£1,110/£1,200 per annum).

Closing date for receipt of applications, 24 Aug., 1955.

ASSISTANT ENGINEER (INSTRUMENTS)
CASTLE DONINGTON POWER STATION

Vacancy No. 132/55/ET

Applicants should have had sound practical experience in the maintenance of instruments in a modern high pressure P.F.

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fired Power Station.

The possession of the Higher National Certificate or equivalent would be an advantage.

Salary will be in accordance with Class L, Grade 10 of the National Joint Board Agreement (£840/£900 per annum).

Closing date for receipt of applications, 24 Aug., 1955.

GENERAL ASSISTANT ENGINEER
NORTH WILFORD POWER STATION

Vacancy No. 134/55/ET

The duties of this position are mainly to assist in the Station Control Room on shift, and to carry out such other operation and investigation duties as may be required.

Applicants should have had some previous experience in a Generating Station and preference will be given to those who hold the Higher National Certificate, or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class K, Grade 15 (£595 x £15—£640 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 6 Sept., 1955.

SENIOR DRAUGHTSMAN (CIVIL)
CONSTRUCTION DEPARTMENT

Vacancy No. 135/55/ET

Candidates should have experience in the preparation of detail drawings and in the design of one or more of the following subjects:

Reinforced concrete structures.
Piled and slab foundations for heavy components.
Cable subways, Bridges and Culverts.

The salary will be in accordance with Grade 4 (£750 x £20—£850 per annum) or Grade 5 (£640 x £20—£740 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 6 Sept., 1955.

GENERAL ASSISTANT ENGINEER
LEICESTER POWER STATION

Vacancy No. 136/55/ET

Duties will be in the Boiler House and Control Room. Qualifications up to Higher National Certificate standard would be an advantage.

Salary will be in accordance with Class H, Grade 16 (£475 x £15—£520 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 6 Sept., 1955.

SENIOR DRAUGHTSMAN (ELECTRICAL)
TRANSMISSION DEPARTMENT

Vacancy No. 137/55/ET

Experience on H.V. Electrical Equipment associated with Substations and Transmission Systems, including preparation of Electrical Diagrams, preferred but is not essential.

Salary in accordance with Grade 5 (£640 x £20—£740 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 6 Sept., 1955.

STATION CLERK
CASTLE DONINGTON POWER STATION

Vacancy No. 133/55/ET

Candidates should have had experience in the administrative work of a generating station, including stores accounting, calculation and payment of wages and work in connection with suppliers accounts.

The salary will be within Grade 4 (£645/£720 per annum) of the National Joint Council Agreement.

Closing date for receipt of applications, 6 Sept., 1955.

These appointments will be pensionable within the terms and provision of the Central Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
(T 827)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area Headquarters, Bedford

TWO THIRD ASSISTANT ENGINEERS
PLANNING AND DEVELOPMENT

141/55.N.

Candidates should have had experience in the planning and construction of urban and rural high voltage and low voltage distribution systems, including substations, they will in the initial stages of the appointments be required to carry out District planning work and may not be located at the Sub-Area Headquarters.

Salary—N.J.B. Class L, Grade 11 (£790/£850).

Apply, by letter, within fourteen days, to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford.

Northmet Sub-Area, Hertford District

GENERAL ASSISTANT ENGINEER (REF. 568)

139/55.R.

Candidates should have a good general and technical education, and should possess the Higher National Certificate in Electrical Engineering or an equivalent qualification.

Salary—N.J.B. Class F, Grade 12 (£555/£600).

Apply, by letter, within fourteen days, to the District Manager, Eastern Electricity Board, Bridgfoot, Ware, Herts. (T 834)

CENTRAL ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following appointments:

SECOND ASSISTANT ENGINEER
(TELECOMMUNICATIONS)
AT DIVISIONAL HEADQUARTERS IN NORTH LONDON

Salary Class AX/DX, Grade 2, £950 x £25—£1,075/£1,165 per annum plus London Weighting.

Applicants should possess professional qualifications equivalent to the requirements for Associate Membership of the Institution of Electrical Engineers and should have had experience in the design, construction, installation and maintenance of all types of telecommunication equipment used by the Authority.

Ability to control staff is essential and the successful applicant will be required to reside within a reasonable distance of Divisional Headquarters.

STATION SHIFT CONTROL ENGINEER
LITTLE BARFORD GENERATING STATION

Salary Class G, Grade 10, £675 x £15—£720 per annum.

Applicants should have reached the standard of Ordinary National Certificate in Electrical Engineering or its equivalent, have experience in the operation of a Switchboard at a Generating Station and be fully conversant with High Tension Switching operation and protective systems.

Applications stating age, details of qualifications and experience should be sent to the Controller, Central Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, not later than 3 Sept., 1955.

W. N. C. CLINCH,
Controller.
(T 807)

AIR MINISTRY
Works Designs Branch

require in London and Provinces (with liability for overseas service) ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage. Salaries up to £810 per annum, starting pay based on age, qualifications and experience. Paid overtime. Posts non-pensionable with long-term possibilities. Natural-born British subjects only. Write stating age, qualifications, employment details including type of work done to any Employment Exchange, quoting Order No. Borough 2307. (T 684)

EAST MIDLANDS GAS BOARD
Sheffield and Rotherham Division

APPOINTMENT OF ELECTRICAL FOREMAN FOR CAR HOUSE GAS WORKS, ROTHERHAM

APPLICATIONS are invited for the position of Electrical Foreman at the new Gas Works at present in an advanced stage of construction at Car House, Rotherham.

Applicants should be qualified and preferably have had experience in the operation and maintenance of electrical equipment in gas works, including turbo alternators and transformers of 1,000 kVA capacity and control gear for motors up to 500 h.p.

They should also be conversant with Electrical Regulations and be capable of controlling electrical maintenance staff.

The salary will be in accordance with APT 6 (*a*) of the National Salary Scales for Gas Staffs (£590/£670 per annum).

The post is pensionable and the successful applicant will be required to pass a medical examination.

Applications giving details of age, training, qualifications, etc., together with the names and addresses of two referees should be addressed to reach the undersigned not later than 31 Aug., 1955.

C. C. WOOD,
Divisional General Manager.

CCW/EMM/PER.
Gas Offices,
Commercial St, Sheffield 1.
5 Aug., 1955. (T 788)

CENTRAL ELECTRICITY AUTHORITY
South Western Division

TECHNICAL STAFF VACANCIES

(*a*) THIRD ASSISTANT ENGINEER, Technical Department, Meter Section, Bristol. N.J.B. Class AX/CX, Grade 4, £750/£875/£925.

(*b*) STATION SHIFT CONTROL ENGINEER, Portishead "A" Power Station. Class J, Grade 10, £755/£800.

Superannuation.

Applicants for (*a*) should have manufacturing and testing experience of bulk supply summation metering equipment and be capable of taking charge of site and bench testing.

For (*b*) applicants should possess good technical qualifications, and have had training and experience in the control and operation of steam generating plant and main switchgear.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 31 Aug., 1955. (T 814)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

WORKSHOP SUPERINTENDENT

APPLICATIONS are invited for the above appointment within the salary range £1,035 x £30—£1,125 per annum (N.J.B. L/7, as for Second Assistant Engineer).

The Sub-Area Workshop is situated at Lister Drive in Liverpool and at present employs approximately 120 men engaged chiefly on the reconditioning of various types of domestic electrical appliances, though there is a small general engineering section.

Applicants must have had a sound engineering training and experience of modern workshop practice and production planning.

The appointment is superannuable and subject to medical examination.

Applications must be made on the special application form obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3. Closing date 12 Sept. 1955. (T 820)

CENTRAL ELECTRICITY AUTHORITY
North West, Merseyside & N. Wales Division

VACANCY No. E.208/273/T.—SHIFT CHARGE ENGINEER, Queens Ferry Generating Station, N. Wales. Salary £595/£640 (B.7).

Applications, quoting Vacancy No., to Divisional Secretary, Central Electricity House, 825 Wilmslow Rd, Manchester 20, before 27 Aug. (T 815)

NORTH WESTERN ELECTRICITY BOARD

(*a*) THIRD ASSISTANT ENGINEER
(*b*) FOURTH ASSISTANT ENGINEER
(SYSTEM PLANNING AND DEVELOPMENT)
SUB-AREA TECHNICAL ENGINEER'S DEPARTMENT, BOLTON

POST (*a*). Applicants must have had a sound training in Electrical Engineering to degree or H.N.C. standard and responsible experience in several of the following branches:

(1) Planning and Construction of 33 kV and lower voltage systems.
(2) Substation design and construction.
(3) Calculation of fault levels, etc.
(4) The specification and application of protective systems.

Post (*b*). Applicants should have had a sound training in Electrical Engineering and be competent to assist the System Planning Engineer in the preparation of schemes and estimates for development and re-development of the H.V. and L.V. transmission and distribution systems. Preference given to applicants who hold the H.N.C. in Electrical Engineering.

Salary Scales:
Post (*a*) £840 x £20—£900 per annum Grade L.10.
(*b*) £715 x £15—£760 per annum Grade L.13.
(N.J.B. Conditions)

ENGINEERING DRAUGHTSMAN, BOLTON DISTRICT

Applicants must have had a good technical training and drawing office experience and should have had experience in the preparation of drawings for some or all of the following:

Switchgear layout and diagrams.
Substation layout and construction.
Overhead line design.
Preparation of wayleave and other plans.

Preference given to applicants holding the O.N.C. in Electrical Engineering and/or Building.

Salary Scale: £510 x £20—£630 per annum. Schedule D, Grade 6, N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 2 Sub-Area The North Western Electricity Board, 2 St. George's Rd, Bolton, by 27 Aug., 1955.

FOURTH ASSISTANT DISTRICT ENGINEER, ROCHDALE DISTRICT

Duties of the post include assisting in the operation and maintenance of the distribution system within the District and constructional work.

The successful applicant will be required to undertake standby duties.

Preference will be given to applicants holding the H.N.C. in Electrical Engineering.

Salary Scale: £595 x £15—£640 per annum. Grade F.11, N.J.B. Conditions.

Applications to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 27 Aug., 1955.

THIRD ASSISTANT DISTRICT ENGINEER, BURNLEY DISTRICT

The successful candidate will be required to assist in the operation, maintenance and construction of underground and overhead mains, substations and transformers, and to undertake standby duties.

Preference given to candidates who have had a sound technical training and who are Graduate Members of the Institution of Electrical Engineers or who possess the H.N.C. in Electrical Engineering.

Salary Scale: £675 x £15—£720 per annum, Grade F.9, N.J.B. Conditions.

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER, BLACKBURN DISTRICT

Duties will include control and supervision of industrial and domestic installation, preparation of specifications, and installation, repair and maintenance of appliances on consumers' premises. Applicants should possess sound technical knowledge in Electrical Engineering and Associate Membership of the Institution of Electrical Engineers will be an advantage.

Salary Scale: £790 x £20—£850 per annum, Grade G.7, N.J.B. Conditions.

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER, RIBBLESDALE DISTRICT

Applicants should be experienced in the supervision of Service Centres, organisation

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of exhibitions, demonstrations and displays. The successful candidate will be responsible for Domestic and Commercial development and the supervision of the staff engaged on that work. Experience in a rural area would be an advantage. Ability to develop business is essential and preference will be given to applicants with technical qualifications.

Salary Scale: £715 x £15—£760 per annum, Grade E.7, N.J.B. Conditions.

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER, RIBBLESDALE DISTRICT

The successful applicant will be required to assist in all normal sales activities including the supervision of Service Centres, exhibitions and displays. Experience in Agricultural and Horticultural applications of electricity will be an advantage. Ability to develop business is essential and preference will be given to applicants with technical qualifications.

Salary Scale: £635 x £15—£680 per annum, Grade E.9, N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 27 Aug., 1955.

THIRD ASSISTANT DISTRICT ENGINEER, STOCKPORT

Applicants should have had experience in planning and estimating of schemes and the operation and maintenance of both underground and overhead networks at voltages up to 33 kV. Preference given to applicants who hold the H.N.C. or equivalent in Electrical Engineering.

The successful candidate will be required to undertake standby duties.

Salary Scale: £675 x £15—£720 per annum. Grade F.9, N.J.B. Conditions.

Application forms can be obtained from the Sub-Area Manager, No. 7 Sub-Area, The North Western Electricity Board, Chapel St, Hazel Grove, Cheshire, and must be returned to him by 27 Aug., 1955. (T 826)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Lanarkshire Area

ENGINEERING APPOINTMENT

APPLICATIONS are invited for the appointment of Second Assistant District Engineer in the Motherwell District.

Applicants should have had a sound engineering training with subsequent experience in the maintenance and operation of H.V. and L.V. Underground and Overhead Distribution Systems and H.V. Fault Location.

The Salary and Conditions of Service for the appointment will be in accordance with the National Joint Board Agreement, Schedule "A": the present Classification and Grading being F.7. Salary £755/£800 per annum, which will be subject to the statutory deductions, including superannuation.

The successful applicant will require to reside within a reasonable distance of the District Offices at Motherwell.

Applications forms, which may be had from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

DUGALD SMITH,
Manager.

137 Almada St,
Hamilton. (T 806)

MINISTRY OF TRANSPORT AND CIVIL AVIATION

require in London MECHANICAL and ELECTRICAL ENGINEERING DRAUGHTSMEN for work on aviation telecommunications projects. Applicants must have experience of (*a*) mechanical detailing of light current electrical engineering assemblies, (*b*) electronic circuit design or (*c*) telecommunications equipment rack assembly and layout. Preference given to candidates with working knowledge of I.D.P./13 Specification governing preparation of drawings. O.N.C. in Electrical Engineering, C. and G. Certificates in Telecommunications or Radio, or equivalent qualifications an advantage but not essential. Salary from £442. 10s. at 21 to £695 (men) and £626 (women). Women's pay being improved under equal pay scheme. Apply any Employment Exchange quoting Order No. Westminster 3753/AC. (T 747)

CENTRAL ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT MAINTENANCE ENGINEER (MECHANICAL)
BARKING "C" GENERATING STATION
Vacancy No. 55/614

Wide experience necessary in maintenance of modern generating plant and control of labour. Duties include organising and planning of overhauls of turbine and boiler plant and associated equipment. Salary—Class J, Grade 8=£882 per annum. (Applicants for previous advert. 55/505 will be considered automatically and need not re-apply.)

ASSISTANT SHIFT CHARGE ENGINEER
STEPNEY GENERATING STATION
Vacancy No. 55/615

Sound engineering and technical training necessary with experience of pulverised fuel firing an advantage. Salary—Class F, Grade 9=£708. 15s. per annum.

GENERAL ASSISTANT ENGINEER
INFORMATION AND STATS. SECTION
GENERATION (O) DEPARTMENT—DIVISIONAL H.Q.
Vacancy No. 55/616

Applicants should preferably have had experience of power station operating records, and must have sufficient knowledge of heat calculations to be able to interpret such records and investigate abnormalities. Speed and accuracy at figure work are essential. Salary—Class AX/EX, Grade 7 =£500/£661. 10s. per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St. W.1, and be received within 14 days of this advertisement. (T 818)

SOUTH EASTERN ELECTRICITY BOARD

SECOND ASSISTANT COMMERCIAL ENGINEER
(Installation and Apparatus Repair)
Surrey Sub-Area Headquarters, Dorking

SALARY £900/£975 per annum in accordance with N.J.B. Grade 8, Class K. Superannuable. Applicants should have had extensive experience in installation work and electrical contracting of all types, a thorough knowledge of the Electricity Supply Regulations and the Regulations for the Electrical Equipment of Buildings and recent experience in the repair and maintenance of domestic apparatus. The person appointed will be responsible to the Sub-Area Commercial Officer for the control of the Sub-Area Apparatus Repair Depot.

Applications, naming 2 referees, on forms from C. W. Hughes, B.SC., M.I.E.E., Surrey Manager, SEEBoard, Rough Rew, Horsham Rd, Dorking, Surrey, by 31 Aug., 1955.

ASSISTANT DISTRICT ENGINEER
Weald District

Salary £675/£720 per annum under N.J.B. Class D, Grade 7. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead systems up to 33 kV.

Applications, naming 2 referees, to W. J. Collins, A.M.E.E., District Manager, SEEBoard, Highgate, Hawkhurst, Kent, by 31 Aug., 1955.

SECOND ASSISTANT DISTRICT ENGINEER
Horsham District

Salary £635/£680 per annum under N.J.B. Class C, Grade 7. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems. Experience of DC/AC changeover an advantage.

Applications, naming 2 referees, to L. J. Simmons, M.I.E.E., District Manager, SEEBoard, 32-40 North St, Horsham, Sussex, by 31 Aug., 1955.

THIRD ASSISTANT DISTRICT ENGINEER
Central Sussex District

Salary £635 rising to £680 under N.J.B.

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Class E, Grade 9. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems up to 33 kV.

Applications, naming 2 referees, to Arthur Barnes, M.I.E.E., Central Sussex District Manager, SEEBoard, Electra House, Church Rd, Haywards Heath, by 31 Aug., 1955.

DISTRICT COMMERCIAL ASSISTANT (N.J.C.)
Eastbourne District

Salary £525 x £20—£585 per annum under N.J.C. Grade 2. Superannuable. Applicants should have experience in negotiating supplies, load development, consumers services, tariffs, sales of electrical appliances and organisation of exhibitions.

Applications, naming 2 referees, on forms from J. E. Winborne, District Manager, SEEBoard, Electric House, Grove Rd, Eastbourne, by 31 Aug., 1955.

A. L. BURNELL,
Secretary.
(T 830)

CITY OF LIVERPOOL
Education Committee

COLLEGE OF TECHNOLOGY
Principal:
E. G. Edwards, B.SC., PH.D., F.R.I.C.

APPLICATIONS are invited from suitably-qualified candidates for the post of Grade "B" Assistant Teacher in the Department of Electrical Engineering. Candidates should possess graduate qualifications in Electrical Engineering, preferably a University Degree including heavy current work. Industrial experience and some teaching practice desirable. Ability to teach Mathematics and Physics to engineering students an advantage.

Salary will be in accordance with the Burnham Scale of Salaries for Teachers in Establishments of Further Education, 1954:

GRADE "B" ASSISTANT
Men—£525 x £25—£820,

plus allowances for graduate qualifications and approved training. Industrial experience and service with H.M. Forces will qualify for increments on the basic salary scale.

Conditions of appointment and forms of application (returnable as soon as possible) may be obtained from H. S. Magnay, M.A., Director of Education, 14 Sir Thomas St, Liverpool 1.

THOMAS ALKER,
Town Clerk and Clerk to the
Local Education Authority.
(J 4037). (T 790)

GOLD COAST LOCAL CIVIL SERVICE

VACANCIES for ENGINEERS (BCD 108/13/03) WIRELESS ENGINEERS (BCD 108/13/04), and MASTER, TELECOMMUNICATIONS ENGINEERING SCHOOL (BCD 108/13/07) exist in the Posts and Telecommunications Department of the Gold Coast Local Civil Service.

Appointments are either pensionable in the salary range £825/£1,630 per annum, or on contract in the salary range £1,130/£2,020 per annum with a gratuity of £37. 10s. for each completed three months satisfactory service. Free first class passages are provided for the officer, his wife and 3 children under 13 years of age. Government quarters if available are provided at reasonable rentals. Leave is granted at the rate of 7 days for each month of resident service.

Candidates for all vacancies should have passed, or be exempt from Sections A and B of the examination for A.M.I.E.E., and have had 2 years' practical experience in the Engineering Department of the British Post Office or with one of the large telecommunications equipment manufacturing firms in the United Kingdom.

1. *Vacancies for Engineers.* Candidates should preferably possess more than the minimum qualifications above and have a wide knowledge and experience of Telecommunications practice and administration. Experience of power generation and distribution an advantage. Duties are the

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chargeship of a telecommunications engineering district involving responsibility for installation and maintenance of overhead and underground telegraph apparatus.

2. *Vacancies for Wireless Engineers.* Candidates should also have had considerable experience with H.F. and V.H.F. fixed and mobile equipment, and air and sea navigational aids. Experience of power generation and transmission would be an advantage. Duties are the chargeship of Wireless Engineering Division or Assistant to Engineer in charge involving installation and maintenance of medium H.F. and V.H.F. W/T and R/T stations operated by Posts and Telecommunications, Police and Civil Aviation Departments.

3. *Vacancy for Master, Telecommunications Engineering School.* Candidates should also have had five additional years' experience in telecommunications engineering, and some experience of teaching. Duties are to be responsible for the training of junior technical staff of the Department in telecommunications subjects by lecturing and conducting correspondence courses, and to assist the Principal of the school in administration and discipline including House duties at the Hostel.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number shown against the post applied for. Closing date for the receipt of initial applications, 26 Sept., 1955. (T 845)

CENTRAL ELECTRICITY AUTHORITY
Midlands Division

APPLICATIONS are invited for the following positions at Nechells "A" Power Station. N.J.B. service conditions, superannuable appointments, salaries within Schedule "A," of the Agreement:

(*a*) SHIFT CHARGE ENGINEER, Grade F7, £755/£800 per annum. (Vacancy No. 37MD.)

(*b*) STATION SHIFT CONTROL ENGINEER, Grade F10, £635/£680 per annum. (Vacancy No. 38MD.)

Applicants should have a sound technical training and practical experience in particular for (*a*) the operation and maintenance of steam generating plant and main switchgear, and for (*b*) the control of steam generating plant and main switchgear. Appropriate technical qualifications will be an advantage.

Apply, quoting the vacancy number, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 3 Sept., 1955. (T 813)

A LARGE firm in West Midlands, marketing all kinds of power sources for electric arc-welding, has interesting opening for qualified ELECTRICAL ENGINEER. Applicants should preferably have had experience in the use of transformers, rectifiers and D.C. generators. Some knowledge of electric arc welding an advantage. The post is pensionable and provides good prospects for a keen engineer wishing to advance in an expanding industry. Generous assistance with housing. Apply giving full particulars of age, qualifications, experience and salary earned to—Box No. 4735, Electrical Times. (T 801)

APPLICATIONS are invited from ENGINEERS of INTER-B.SC., or Higher National Certificate standard for investigational and development work on thermionic valves. Five-day week, staff pension scheme, modern welfare amenities. Apply, giving full particulars of age, qualifications and experience to Personnel Superintendent, The Edison Swan Electric Co., Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. (T 795)

ASSISTANT ENGINEER / SURVEYOR required in connection with overhead line work in East Scotland. Applicants should have experience in this type of work and preferably be under 40 years of age. Applications giving details of training, experience and age to Employment Manager, Messrs Johnson and Phillips Ltd., Victoria Works, Charlton, S.E.7. (T 694)

THE ENGLISH ELECTRIC COMPANY'S GUIDED WEAPONS DIVISION, LUTON,
are looking for

A Senior Electrical Engineer
who will be expected to cover a wide field, including investigation into the application of electro/mechanical devices and small to medium power motors to specialised purposes. Ability to contribute original ideas will be expected, as well as sound design experience and appropriate technical qualifications, not below H.N.C.

Opportunities to progress are excellent for a man of good personality as well as technical ability, and housing assistance can be given to the selected candidate.

The salary will be commensurate with qualifications and experience in an appointment of a very progressive nature.

Applications to Dept. C.P.S., 336/7, Strand, W.C.2., quoting Ref, 254X.

(T 837p)

A SERVICING ENGINEER with a thorough knowledge and experience of the domestic electrical appliance trade is required immediately in the N.W. London area to establish and develop the servicing department of a large manufacturing organisation concerned with the production of a wide range of domestic appliances. Applicants should for preference have Higher National Certificate in electrical engineering and have tool making experience. Ordinary National Certificate will be regarded as minimum technical qualification.

This is a good opportunity for a man who has the technical and administrative ability and the drive, initiative and enthusiasm to develop a new and interesting field. The post is pensionable and a good salary will be paid to a man with the qualifications required. Applications giving full particulars of present employment and past experience should be addressed to Box ET750, L.P.E., 55 St. Martin's Lane, W.C.2. (T 838)

AGENT required for Northumberland, Cumberland, Westmorland and Durham. Must have knowledge of Electric Motors and their application. Please write to: Personnel Manager, Small Electric Motors Ltd., Churchfields Rd, Beckenham, Kent. (T 836)

AGENTS with technical electrical knowledge required for North East coast area for Switchgear and Motor Control Gear. Must have established connection with industry in that area. Reply, giving full details, to Erskine, Heap and Co., Ltd., Lancashire Switchgear Works, Manchester 7. (T 743)

ELECTRICIANS

SEVERAL ELECTRICIANS required on Aircraft installation work. Although previous experience on modern aircraft is desirable—applications are welcome from Naval and R.A.F. electricians—all men who are capable of high class installation work are invited to apply. Good rates and all facilities.

Call or write:

Personnel Officer,
HAWKER AIRCRAFT LTD.,
Sutton Lane, Langley (near Slough) Bucks.

(T 812p)

ARMATURE AND STATOR WINDERS required. Applicants must have wide experience of A.C. and D.C. work, preferably in Repair Shops. Good permanent positions available to first class men. The Midland Electric Installation Co., Ltd., Cyprus Works, Upper Villiers St, Wolverhampton. (T 841)

ASSISTANT WORKS MANAGER required for new factory at Crawley, Sussex, engaged on Transformer manufacture up to 100 kVA and light electrical control equipment. Essentially a good disciplinarian. House available if required. A progressive situation offering good scope for a keen person. Full details to—Box No. 4693, Electrical Times. (T 597)

CHIEF ELECTRICAL ENGINEER wanted to take charge of modern electrical plant of a large sugar factory in the British West Indies, consisting of about 4,000 kW of steam turbine and diesel generators and 5,000 h.p. of motors, etc. Contract for three years at a salary of £1,600 per annum, with free quarters and passages paid. Applicants who are fully qualified, preferably Chartered Electrical Engineers and used to the operation of steam turbines, should give details of training and experience, stating age and whether married or single, to Box No. T.146, c/o Streets, 110 Old Broad St, E.C.2. (T 842)

DESIGNER required with experience of Distribution and Medium Power Transformers up to 5,000 kVA, 33 kV or over. Permanent and progressive position. Salary commensurate with experience and qualifications. Apply, in confidence, to Chief Engineer, Transformers (Watford) Ltd., Sandown Road, Watford, Herts. (T 693)

DEVELOPMENT ENGINEER (with Degree) required for telecommunication cables and testing equipment. Permanent and progressive position with pension scheme. Please apply, giving full particulars to—Box No. 4743, Electrical Times. (T 824)

DRAUGHTSMEN required Electro-Mechanical work of varied nature, knowledge of circuitry an advantage but not essential. Salary in accordance with age and experience. Pension scheme. Write giving details of experience, etc., quoting (Ref.: STK 29). The General Electric Co., Ltd., Union Works, East Lane, North Wembley. (T 840)

ELECTRICAL DESIGN AND DEVELOPMENT ENGINEER required, must be qualified. Experience in design of small and medium switches essential. Position has good prospects and is pensionable. Applicants should be between 30/45 years of age. Apply stating experience and salary required to Arrow Electric Switches Ltd., Hanger Lane, Ealing, W.5. (T 811)

ELECTRIC Lamp Manufacturers have a vacancy in their London Office for person (preferably with electrical background) to be responsible for stock control and production planning. This can prove an interesting and progressive situation for one not afraid of hard work and demands real ability and initiative to co-ordinate requirements of several branches.—Box No. 4731, Electricaf Times. (T 799)

ELECTRICAL Appliance Testing Laboratory at Leatherhead has vacancies for:

1. TEST ENGINEER. Previous experience in electrical testing laboratories essential. Knowledge of design of domestic electrical appliances advantageous. Higher National Certificate or similar qualification. Salary £615/£840 per annum according to experience.

2. JUNIOR TEST ENGINEER. Young man having completed National Service. Minimum qualifications—National Certificate in Electrical Engineering or Applied Physics. Salary £455/£545 per annum according to experience.

Applications to the Director and Secretary, British Electrical Development Association, 2 Savoy Hill, W.C.2. (T 822)

ESTIMATING STAFF required. Male or Female. Write stating age, experience and salary required to the Cable Makers' Association, 52/54 High Holborn, London, W.C.1. (T 847)

ELECTRICAL POWER ENGINEERS' ASSOCIATION

APPOINTMENT OF AREA SECRETARY

THE NATIONAL EXECUTIVE COUNCIL of the Electrical Power Engineers' Association invites applications for the appointment of an Area Secretary.

Applicants should be under 45 years of age and it would be an advantage to have had experience in the electricity supply industry, preferably on the technical side.

The successful applicant will be required to operate in the North Western Area of the Association and to reside in or near Manchester.

The commencing salary will be £930 per annum, rising by three annual increments to £1,080.

In the first instance, application for fuller particulars of the appointment should be made to the undersigned *not later than 9 Sept.*

H. NORTON,
General Secretary.
102 St. George's Sq,
London, S.W.1. (T 797p)

ELECTRICAL ENGINEER required, not more than 30 years of age, with qualifications at least up to H.N.C. standard with experience of motor control gear and an understanding of schematic and wiring diagrams. Reply stating age, qualifications and salary required to Marshall Richards Machine Co., Ltd., Crook, Co. Durham (T 796)

ENGINEERS required by Consulting Engineers in London for the design of electrical services in a variety of buildings. Ability to draw and prepare specifications essential and previous consulting or contracting experience desirable. Write giving full details of qualifications, experience and salary required to Box ET751, L.P.E., 55 St. Martin's Lane, W.C.2. (T 839)

INTERESTING CAREER IN HIGH POWER ELECTRICAL TRANSFORMER WORK IS OFFERED BY THE ENGLISH ELECTRIC COMPANY STAFFORD and LIVERPOOL

A special one year course will commence in September next for young men who have completed National Service and have a University Degree or Higher National Certificate or similar qualifications in electrical engineering.

The course is intended to produce young transformer engineers in the commercial and design fields.

Salaries from £425/£550 per annum will be paid during training, and permanent pensionable posts with attractive prospects are available at home and abroad at the end of the training period.

Apply to Dept. C.P.S., 336/7 Strand, W.C.2,
quoting Ref.: 396M

(T 762p)

INSTRUMENT SALES ENGINEER

A highly qualified Instrument Sales Engineer is required to take complete control of the Sales and Contracts Department of a leading Company's rapidly expanding indicating instrument business.

This position is an important one and consequently open only to an engineer having wide experience in instrument design and sales; and possessing drive, initiative and proven sales ability.

Technical education to Degree or H.N.C. standard is essential and membership of a professional institution would be an advantage.

A four-figure salary will be offered to the successful candidate; but the point of entry will depend upon qualifications and experience.

Consideration will be given to providing housing accommodation if required, and membership of a non-contributory pension scheme will follow the satisfactory completion of a probationary period.

Applications, which will be accorded the strictest confidence, should contain full particulars of candidate's qualifications, previous experience and present position and be addressed to—Box No. 4741, Electrical Times, quoting ref. "Instruments." (T 823p)

ELECTRICAL ENGINEER/DRAUGHTSMEN required by Ashmore, Benson, Pease and Co., Stockton-on-Tees, for complete electrical installation, design, including motor application, control scheme engineering, distribution and cabling. Experience of contract work and estimating an advantage. Maximum assistance given in obtaining accommodation, one house and two flats already available. Pension Scheme, Technical Library and sports facilities available.

Apply stating age, experience, etc., quoting Ref. W, to Staff Personnel Officer. (T 761)

ESTIMATING ENGINEERS required, having a good electrical engineering background with a knowledge of excavation and concrete work. Experience of contract conditions and the preparation of schedules, variations, etc., is desirable. The work relates to cathodic protection of piping, steelwork, tankage, etc. These posts are progressive and the successful applicants would be required to deal with the management of small contracts. Knowledge of cathodic protection an advantage but not essential. Non-contributory pension scheme and luncheon vouchers. Applications stating full details of previous experience, quoting ref.: B5039, should be sent to the Personnel Manager, Costain-John Brown Ltd., 40 South St, W.1. (T 825)

IMPERIAL CHEMICAL INDUSTRIES LTD., Lime Division, Buxton, Derbyshire, has a vacancy for an ELECTRICAL ENGINEER. Candidates should possess a degree in Electrical Engineering and have had some industrial experience on heavy electrical plant and equipment operating at voltages up to 11,000. A knowledge of automatic control equipment as applied to plants and processes is desirable. The division operates large mechanised limestone quarries with electrically-operated excavating and drilling equipment, crushing plants, vertical and rotary kilns, lime and limestone processing plants, etc. The main works are situated near Buxton in the Peak District of Derbyshire. Excellent conditions of employment are available, including Staff Pension Fund. After joining the staff married men will receive a reasonable refund of removal (including travel) expenses, and to assist them in house purchase, facilities could be made available in approved cases for loans. Write, giving details of age, qualifications and experience to Division Staff Officer, at the above address. (T 765)

HOWDEN have an immediate vacancy for a TECHNICAL ENGINEER (ELECTRICAL) to undertake preparations of schemes and tenders for mainly heavy industrial electrical installations and to administer contracts. A degree or Higher National Certificate in electrical engineering and some experience of industrial installations essential. The post is pensionable and carries a good salary. Apply to: Personnel Manager, James Howden and Co., Ltd., 195 Scotland St, Glasgow, C.5. Tel.: South 2131. (T 798)

LEADING Oil Company has vacancy in Middle East for ELECTRICAL CRAFTS SUPERVISOR. Applicants, aged under 30, must have served full apprenticeship and have a thorough practical knowledge of the maintenance and overhaul of heavy electrical equipment up to 650 h.p. at 3,300 V, including fault finding on control circuits. Attractive salary plus generous allowance in local currency, free passages out and home, good leave arrangements, free medical attention, Pension Scheme, Kit Allowance. Write giving full details of experience, quoting F.507, to Box 1486, c/o 191 Gresham House, E.C.2. (T 810)

LONDON E.W.F. Wholesaler invites applications to fill a new post offering considerable interest to a keen man. Applicants must have had experience in the electrical trade and give full particulars. Apply Manager—Box No. 4733, Electrical Times. (T 800)

SENIOR ESTIMATOR required with initiative and having experience in handling comprehensive enquiries involving rotating electrical machinery up to 5,000 h.p./kW. A superannuation scheme in operation and the usual social amenities available in an organisation of progressive outlook. Promotions inside, and transfers to Sales normally made from staff. All applications will be treated with the strictest confidence and should be addressed to the General Manager, Lancashire Dynamo and Crypto Ltd., Trafford Park, Manchester 17. (T 763)

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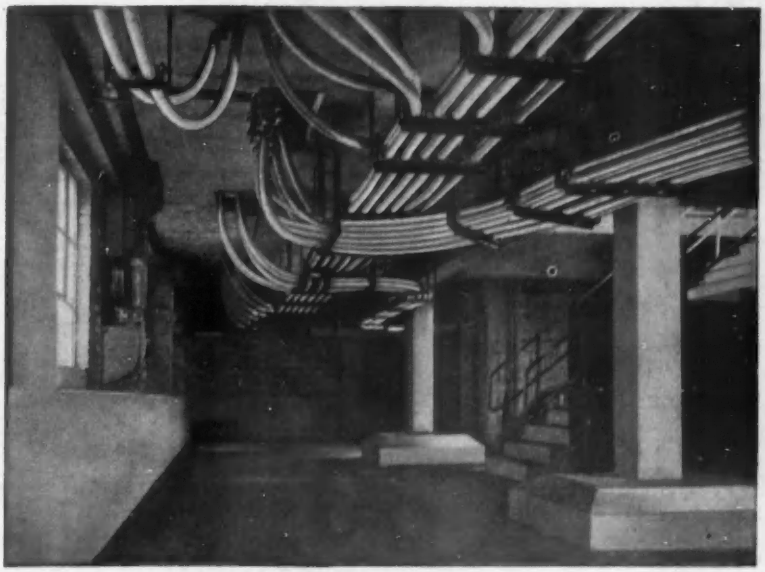

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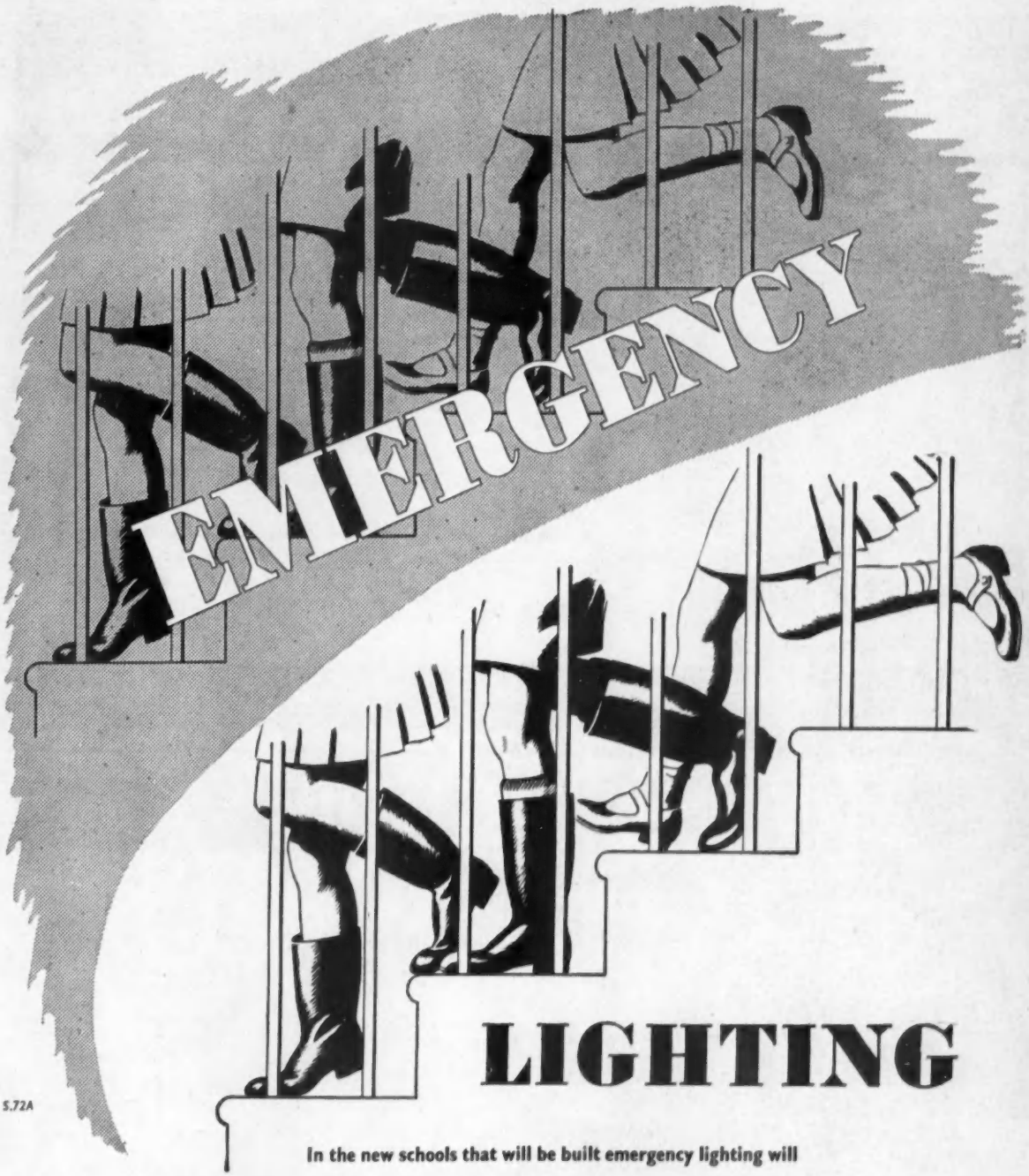

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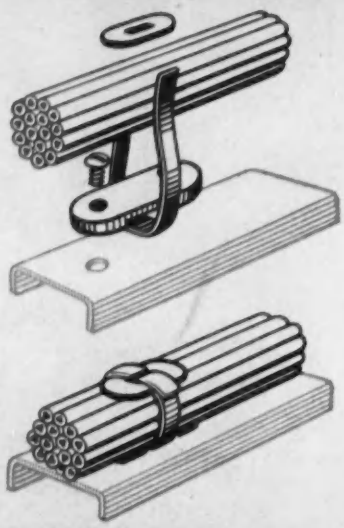

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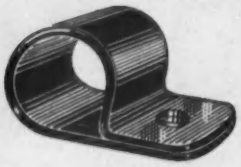

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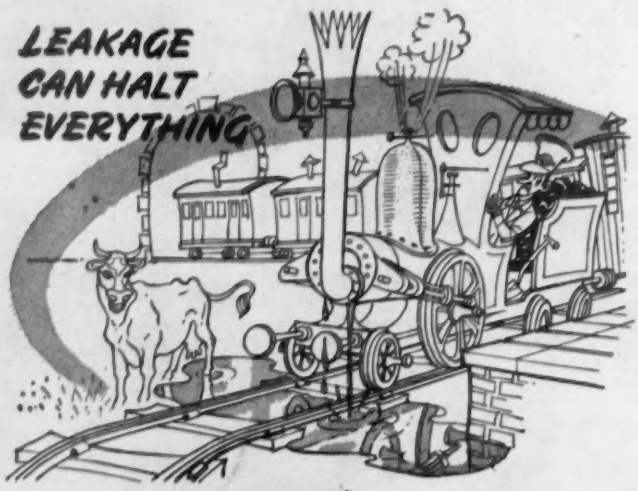

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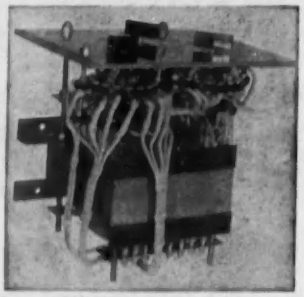

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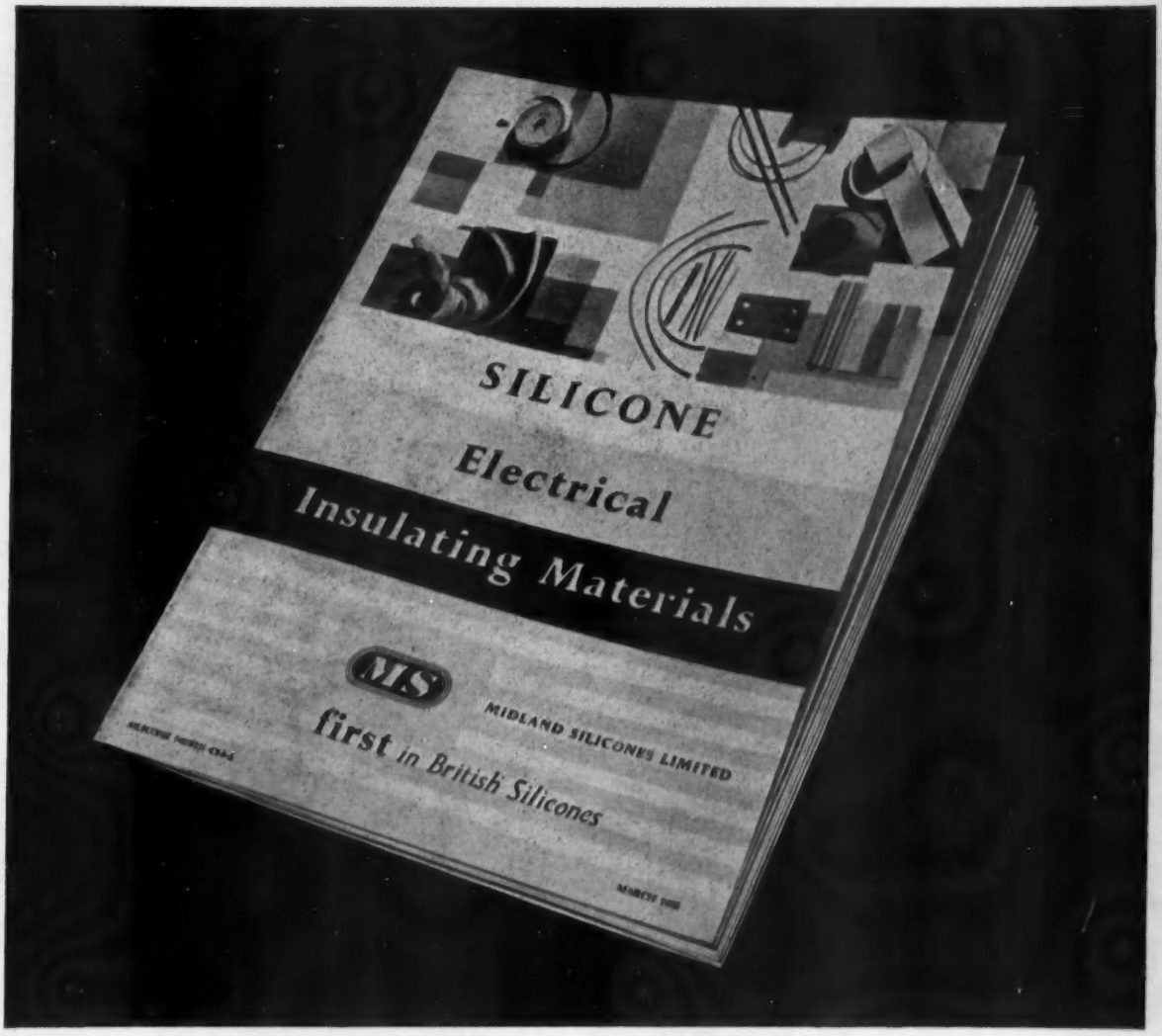

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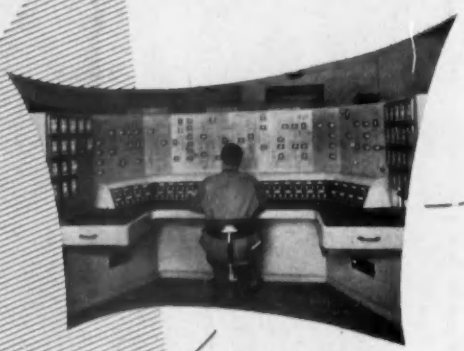

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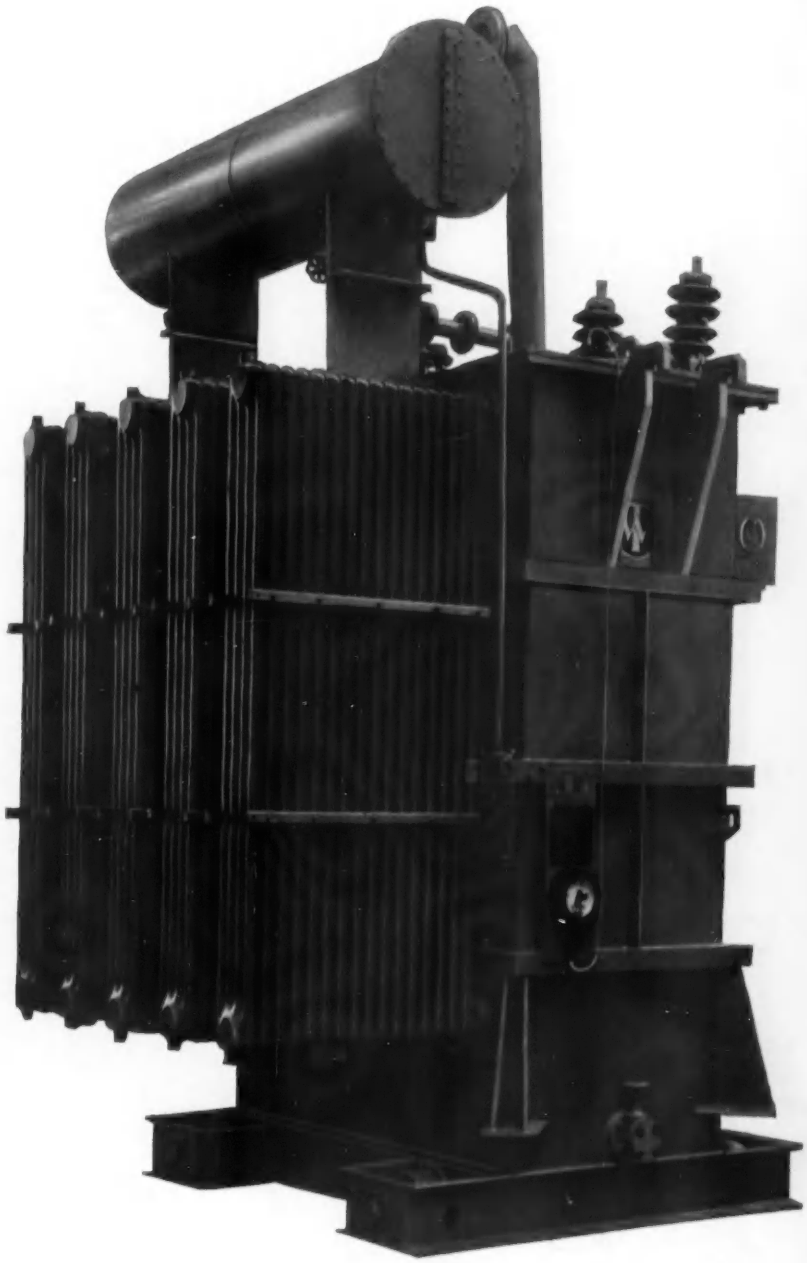

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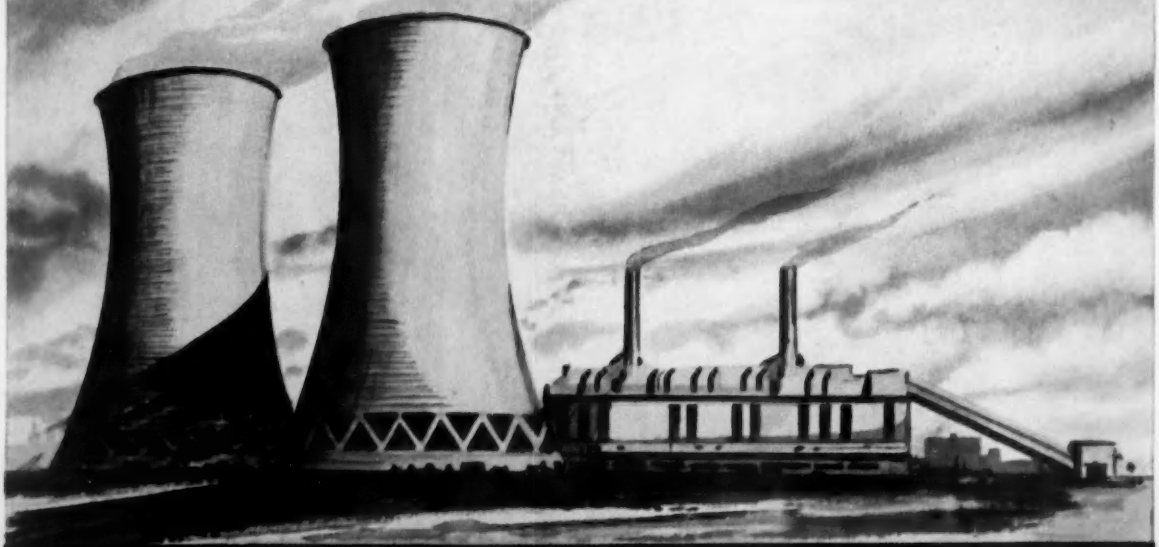

HICK HARGREAVES

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